

From: [Maura Kwiatkowski](#)
To: ["rosemont401comments@azdeg.gov"](#); [kmcolloton.spl@usace.army.mil](#); [Blumenfeld, Jared](#)
Subject: ADEQ CWA Section 401 Certification - Rosemont Copper - 27-14AZ LTF 55425
Date: Friday, March 21, 2014 9:25:29 AM
Attachments: [0_pima.county.rosemont.401.comments.pdf](#)

Good morning, Mr. Scalamera.

Please see the enclosed correspondence from Mr. Huckelberry regarding this subject.

Regards,
Maura

Maura J. Kwiatkowski
Chief Administrative Assistant to
Pima County Administrator Chuck Huckelberry
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C.H. HUCKELBERRY
County Administrator

March 21, 2014

Robert Scalamera, Project Manager
Arizona Department of Environmental Quality
Surface Water Section, MC5415A-1
1110 West Washington Street
Phoenix, Arizona 85007

Re: **Arizona Department of Environmental Quality ADEQ Clean Water Action Section
401 certification for Rosemont Copper, Public Notice 27-14AZ LTF 55425**

Dear Mr. Scalamera:

This letter presents the combined comments of the Pima County Regional Flood Control District (RFCD) and Pima County regarding the proposed 401 certification for the Section 404 permit for the Rosemont Copper Project, Public Notice/Application No.: SPL-2008-00816-MB. The corresponding address is provided above.

Pima County and the Regional Flood Control RFCD have previously commented on the Clean Water Act (CWA) Section 404 application for this project and participated as a Cooperating Agency in the development of the Final Environmental Impact Statement (FEIS). We appealed the Aquifer Protection Permit (APP) for this project; and in view of the need for future significant modifications of that permit to conform to new mine designs, we negotiated with the applicant several provisions that addressed our concerns with that version of the APP.

In addition, the County and RFCD are affected parties by virtue of our downstream location (see Figure 1 below). The County and RFCD own the land and water rights in the Outstanding Waters reach of Davidson Canyon and the Outstanding Waters reach of Cienega Creek downstream of the Davidson Canyon that would be affected by this project. Further, the County and RFCD manage the Bar V Ranch and Cienega Creek Natural Preserve for wildlife and recreation purposes and oversee ranching at the Bar V Ranch.

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The CWA Section 401 certification for this project is an important test of the meaning of the anti-degradation provisions of the Outstanding Waters program. We proposed or supported the original state designations for Davidson Canyon and Cienega Creek as Outstanding Waters based on the belief that this designation would prevent ADEQ from issuing permits that would degrade the water quality of these streams.

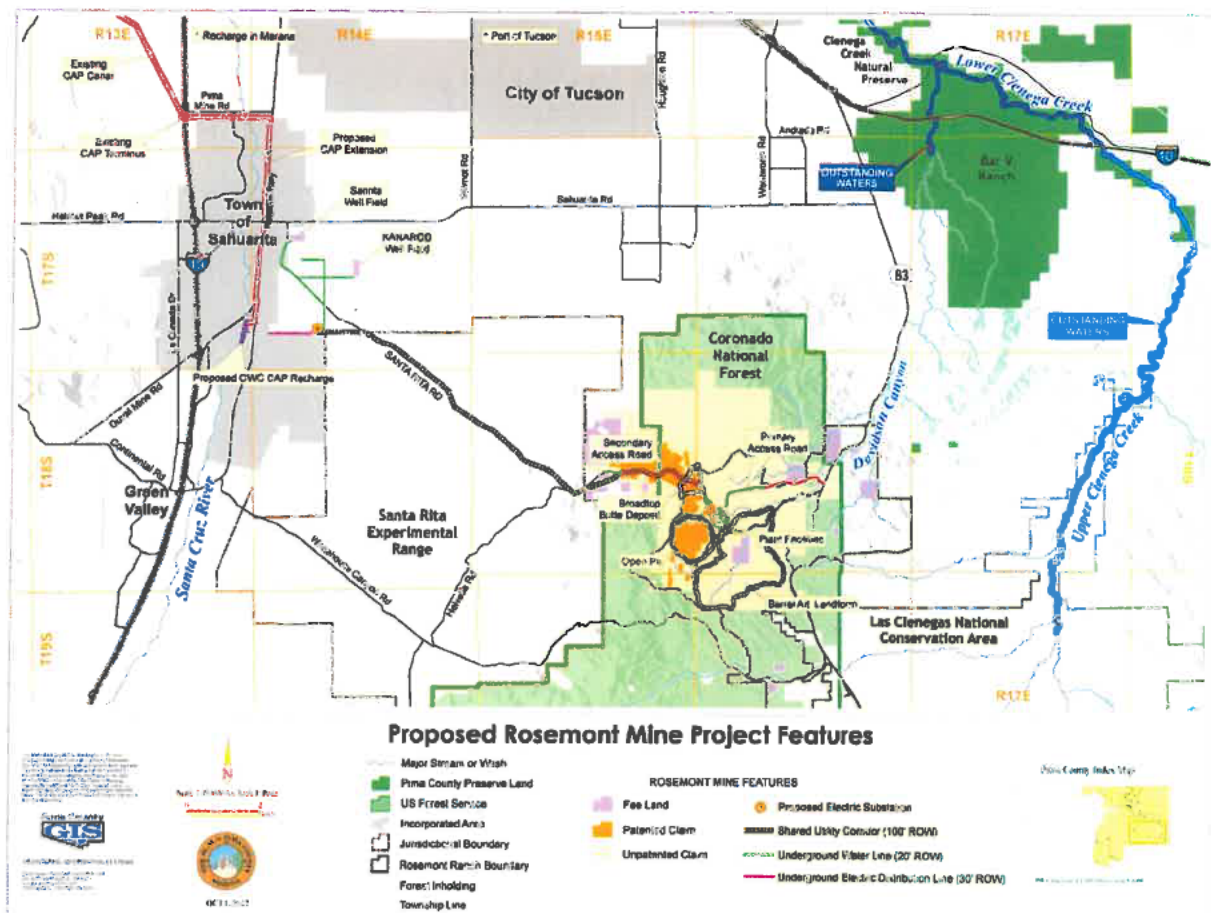


Figure 1. The Outstanding Arizona Waters reaches of Cienega Creek and Davidson Canyon, which will be impacted to the Rosemont Mine, flow through Pima County properties (Bar V Ranch and Cienega Creek Natural Preserve).

ADEQ's certification process is a grave responsibility. Residents of eastern Pima County have historically suffered contamination of groundwater from surficial discharges from mines and other industries. These events were seminal in the development of your agency.

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This particular certificate is important to residents of eastern Pima County because the Rosemont mine is in the contributing watershed and groundwater basin of Tucson's aquifers, which still provide water supply to Vail and other areas. Studies by The University of Arizona have found isotopic evidence that a considerable areal extent of Tucson's aquifer originates from the Cienega Basin and extends from Vail as far as The University of Arizona itself (see Figure 2 below and Attachment 1).

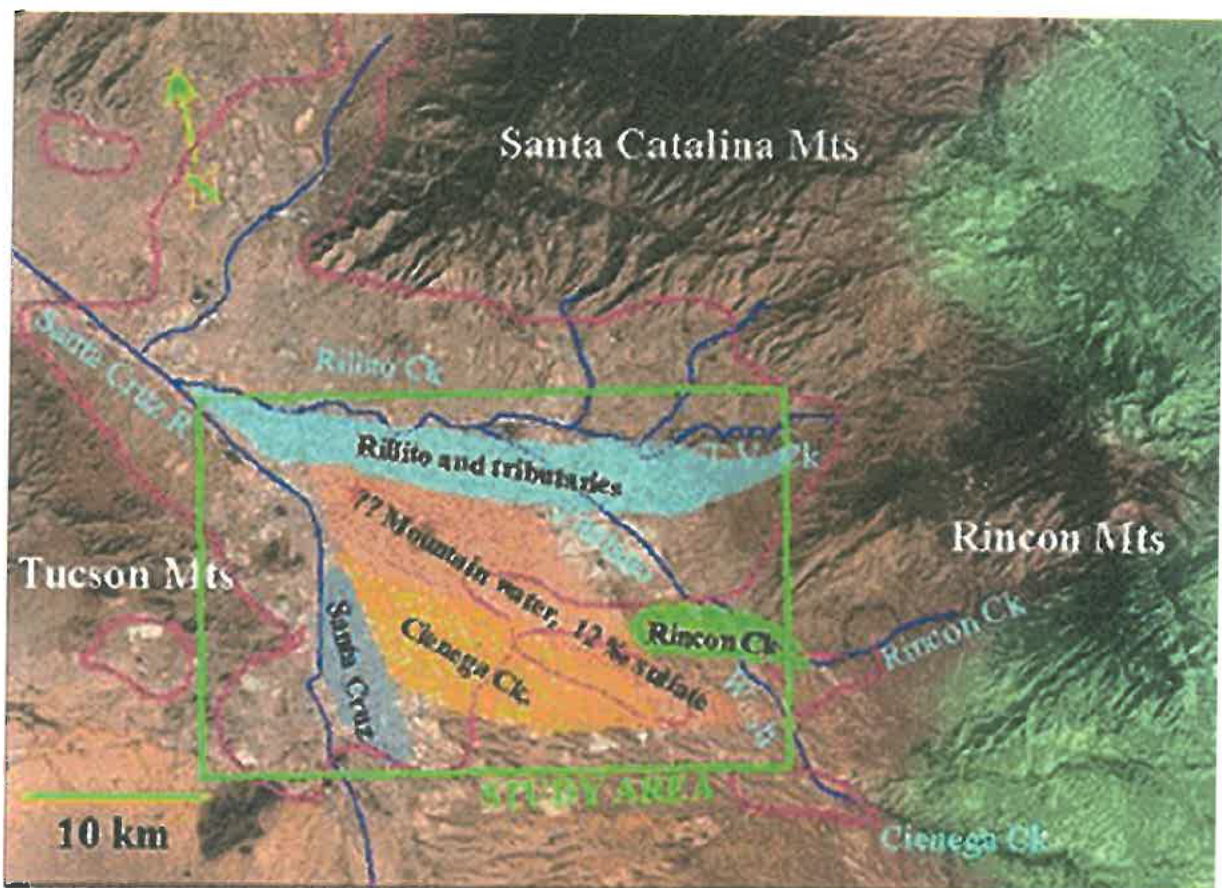


Figure 2. Groundwater recharge domains inferred from isotopic analysis showing the importance of Cienega Creek on the Tucson Basin Aquifer (Eastoe and others, 2003; Attachment 1).

ADEQ proposes to conditionally certify that this mine will not exceed water quality standards. However, we recommend the certification be denied for the following reasons:

1. The certification is based on an evaluation of inconsistent descriptions of activities provided by the applicant, all relating to differing mine designs;
2. Insufficient information has been provided to ADEQ by the applicant to certify the proposal or demonstrate compliance;

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3. There is no reasonable assurance the activity can be conducted in a manner that will not violate applicable water quality standards;
4. ADEQ has not certified that the project will not degrade Outstanding Arizona Waters;
5. Pima County believes the project will cause or contribute to degradation of water quality and violate State Water Quality standards;
6. There are practical alternatives that would reduce impacts on water quality and the watercourse ecosystems;
7. The certification is inconsistent with the Arizona Governor's Executive Order No. 89-15 on riparian resources and No. 91-6 on protection of riparian areas, which declare the importance of riparian areas and direct that "all state agencies shall rigorously enforce their existing authorities to assure riparian protection, maintenance, and restoration" (Executive Order 91.6); and
8. The design of the Forest Service's preferred alternative is at odds in several respects with the proposed conditions of this permit, and therefore the mine cannot meet the terms of the certification.

Overall, the proposed conditions appear to be largely a boilerplate imposed on a hopeless muddle of mine designs. There is little evidence of specific conditions that refer to the particular risks this mine presents. The language of this permit shows lack of coordination with the terms of the Forest Service approvals. In the event this mine is approved, it is essential that ADEQ's permits hew closely to what would be approved by the Forest Service.

We request that ADEQ deny the CWA Section 401 certification for Rosemont Copper based on the reasons summarized above and the detailed comments attached to this letter.

Sincerely,



C.H. Huckelberry
County Administrator

CHH/mjk

Attachments

c: Colonel Kimberly Colloton, Los Angeles District Engineer, US Army Corps of Engineers
Jared Blumenfeld, Region IX Administrator, US Environmental Protection Agency

**Pima County Staff Review of the Draft Arizona Department of Environmental
Quality 401 Certification for
Rosemont Copper (Public Notice 27-14AZ LTF 55425)**

Pima County staff offer the following comments on the proposed certification:

Part 1.0 AUTHORIZATION

1. This certification states that the proposed activities *“will not violate applicable water quality standards in the subject waterbodies....all ephemeral tributaries to Davidson Canyon....”* In order to make this certification, the Arizona Department of Environmental Quality (ADEQ) should complete the anti-degradation review, but there is no evidence that such a review has been completed. Until such has been completed, this authorization is premature.
2. This certification is based on applicable water quality standards for the subject waterbodies, but ADEQ has not demonstrated that the project activities will not violate the standards.
3. With reference to the “ephemeral” nature of the subject waterbodies, please note that applicant did not assert that the waterbodies are all ephemeral. Some of the waterbodies are intermittent springs and streams. The water table under many of the APP-regulated facilities is 20 feet or less (Rosemont APP-Regulated Facility Depth to Groundwater, Tetra Tech 2010; Attachment 2) and even less along portions of Barrel, Wasp and McCleary Canyons. Major recharge events in the project area have the potential to bring the water table to the surface.

Part 2.0: DESCRIPTION OF ACTIVITIES BEING CERTIFIED

4. The draft permit certification language describing the activities is too vague to be enforceable. This is a permit that has impact areas distributed in various small locations scattered over two watersheds—it will be unclear to contractors what is in the permit and what is not. This is complicated by the fact that during the past several years, Rosemont has changed the mine design, and thus the activities that occur within the Waters of the United States (WUS).
5. The permit makes unexplained reference to changes made during the development of the FEIS. Are we to understand that this certification is based on one of the alternatives as proposed in the FEIS? (If so, please state which one.) Or is the certification based on the mine as designed in the original 404 application?
6. Even the FEIS is internally inconsistent. For instance, the compliance point dam referenced on p. 46 of the FEIS is not described in figure 9 of the 404(b)(1) analysis, but

the sediment control dam on Trail Canyon (shown in figure 9 of the Corps alternative analysis) is not mentioned elsewhere. The original 404 application references only one dam. Please state which structures were included for the purpose of your review.

7. The application from Rosemont indicates a total of 101.6 acres of impacts to jurisdictional waters, but the certification indicates 38.6 acres. Furthermore, the 38.6 described in the 404 Public Notice (Application SPL-2008-00816-MB) is for a mine configuration that is no longer being proposed. For example, the heap leach pad is not in the FEIS, but was included in application SPL-2008-00816-MB.
8. The points of discharge authorized to the WUS should be described in this permit.

Part 3.0: INFORMATION REVIEWED

9. The January 12, 2012 certification package cited for this proposal was for a different mine design than is currently proposed as the Barrel alternative in the FEIS. On July 10, 2012, Rosemont Copper informed U. S. Forest Service that they would not “complete the leaching process and fully recover the copper from the oxide ore materials”. Does this certification reference the mine that includes the heap leach as proposed in the 404 and 401 applications? If so, please clarify. Does it include flow-through drains referenced in the 401 application or not?
10. Within draft 401 certification Section 3.0, there is no reference to a review of the draft or final Stormwater Pollution Prevention Plan (SWPPP) for AZPDES MSGP – 2010 (Permit No. AZMSG2010 – 003). ADEQ has authority under ARS 49-202 to request this supplemental information. ADEQ had been scheduled to provide Rosemont Copper review comments on the July 2013 draft of this document in February, 2014. The July 2013 draft SWPPP contained incomplete descriptions and information, and a number of missing figures. ADEQ should review the final SWPPP for the site—hopefully prepared in conjunction with facility design and operations described in the final MPO—prior to issuing a 401 certification, which states that discharges from the mine complex will not result in a violation of State surface water quality standards.
11. The public should be provided an opportunity to review the SWPPP document in its entirety prior to finalization.
12. The listing of information reviewed does not include the *Preliminary Site Water Management Plan for the Barrel Alternative* (Rosemont Copper Project, Tetra Tech, July 2012). Although not known or available to the public, a “final Site Water Management Plan” might be included within the final MPO.
13. ADEQ did not cite the 2010 Site Water Management Update and the “Site Water Volume [X] April 2010” referenced by the applicant’s 401 application. What did ADEQ use as the basis for the description of measures to be taken to control discharge of pollutants?

14. The document: "Rosemont Conceptual Barrel Alternative Stormwater Control Alternatives" (January 31, 2012) by Ronson Chee of TetraTech, is cited by ADEQ as a supporting document. This document predates many adjustments to the mine design that the company proposed later that year. If ADEQ's relied on this outdated document, then it clouds the ability of the public, contractors or any other parties to understand the activities being certified, particularly given that the application itself references a different set of documents.
15. Within Section 3.0 of the draft 401 certification, there is no reference to a review of the *Final Mine Plan of Operations* (final MPO) referenced in the draft Record of Decision, which is also to include the *Final Reclamation and Closure Plan*. This document, which may now be available, apparently incorporates all modifications made to the proposed facility design, operations, and compliance as a result of the culmination of the entire EIS process, including federal, state, cooperating agency and public input. For this massive industrial complex, how can ADEQ certify that the discharge will not result in a violation of State surface water quality standards in McCleary, Scholefield, Wasp and Barrel Canyons without a review of the final MPO document? The permit should be denied on the basis of the inconsistent information provided by the applicant and reviewed by ADEQ.
16. ADEQ has no relief from the licensing timeframes imposed by the applicant's decision to request a permit; however we request to have a public hearing on the anti-degradation review prior to finalization of this permit. In the event that ADEQ finalizes the permit without further public review, we request a public hearing be provided when the permit is amended.
17. SWCA (2013; memorandum from Chris Garrett entitled "Revised Analysis of Surface Water Quality"; cited in the FEIS) has provided information that stormwater flows on Barrel Canyon do not meet all applicable water quality standards. No further degradation of existing water quality is permitted in a surface water where the existing water quality does not meet applicable water quality standards. Thus, this certification is premature and needs to be coordinated with additional baseline characterization for Barrel Canyon, and potentially a 303(d) listing.
18. No relevant documents provide a basis for determining the source of the observed metals. While there are ore deposits at or near the surface to contribute to natural levels of metals in runoff, it may also be that there are point or non-point sources in the numerous small mine pits, shafts, adits, or mine wastes and tailings from previous mining activities.
19. The relevant documents should include Rosemont APP-Regulated Facility Depth to Groundwater (Tetra Tech 2010; Attachment 2). This document shows that the water table under many of the APP-regulated facilities is 20 feet or less. There is a substantial

potential for interchange between the aquifer and WUS at these locations and other areas where dredge and fill activities occur.

Part 5.0: CONDITIONS FOR STATE 401 WATER QUALITY CERTIFICATION

20. This certification requires that native material be free of pollutants, but this has not been demonstrated. In fact, SWCA (2013) provides evidence that sediment transported in flood flows is not free of pollutants. The source sites for these pollutants are unknown. We would like this to be demonstrated by the applicant, or know ADEQ's basis for such a determination.
21. If this condition would permit use of truck tires for revetments in WUS, please specify the conditions under which this would be considered.
22. The FEIS (page 470) states that "inert or acid-neutralizing waste rock shall be used to build haul roads and buttresses around waste rock and tailings facilities to provide a buffer zone that would isolate potentially acid-generating materials from water infiltration and storage". Furthermore, the mine would segregate any acid-generated rock as required by the APP. The FEIS is built around the assumption that the metals are mobilized only from acid-generating rock, but this assumption has not been proven.
23. Like Rosemont, the Oracle Ridge mine is a copper skarn with abundant limestone. At Oracle Ridge, the stormwater monitoring program has provided evidence of mobilization of metals in stormwater runoff and spring water from the mine, despite the fact that the host rock is limestone, the pH is alkaline, the hardness is very high. Dissolved copper often exceeds the applicable standard in base flows and stormwater, and total arsenic, beryllium, cadmium, copper, lead have exceeded standards in stormwater runoff.
24. The original 404 application states that "mine haul road will be constructed using material excavated from the open pit, typically consisting of limestone, skarn, arkose, andesite and quartz monzonite rock types." The FEIS says the road will be constructed of "inert or acid-neutralizing rock." The waste rock for the Barrel Alternative includes 65 million tons that were defined (at the time of the 2011 404 application) as oxide ores of copper (FEIS, page 33). This oxide material is located near the surface of the deposit (FEIS, page 32), and would need to be moved during the early years of the operation. It is therefore logical to require a demonstration that pollutants will not be discharged when waste rock is placed into road beds, dams and berms and discharged into WUS. We see elevated levels of metals, primarily copper, in runoff from the Oracle Ridge mine area, despite the abundance of limestone. If ambient runoff from the Rosemont area already exceeds standards for certain metals, then pollutant discharge cannot be avoided when soil and vegetation is removed, flows paths are shortened, and the waste

rock is further crushed and discharged into WUS at roadway crossings and other facilities.

Part 5.1: GENERAL CONDITIONS

25. *"If monitoring, by ADEQ or others, indicates that water quality is adversely affected by the activities certified herein, ADEQ will notify the CoE and request suspension of the CWA 404 permit"* (p. 4 of 9). Per this draft 401 certification statement, ADEQ should formally request the CoE suspend mining operations until such time that water quality non-compliance issue(s) have been remedied by Rosemont Copper.
26. Per the draft 401 certification at condition #1, contractors and subcontractors will receive a copy of the 401 Certification. A legible copy will also be available at the construction site *"where it may be seen by workers"*. These stated actions are wholly insufficient to ensure compliance with 401 Certification general and specific conditions. Similar to SWPP requirements, each and every worker employed by Rosemont Copper or contracted by Rosemont Copper should be trained regarding the 401 Certification general and specific conditions, provided a personal copy of the certification, and systematically monitored by designated individuals to ensure day-to-day compliance.
27. Per the draft 401 certification condition #2, *"The applicant shall notify ADEQ of project completion within 30 days following project completion"* (p. 5 of 9). Does "project completion" coincide with the final placement by Rosemont Copper of fill, waste rock or tailings in the permanent impact zones of WUS? This may require 10 or more years of mine operations. ADEQ should evaluate site conditions on a regular basis during each year of mine development, mining operations, and during the reclamation and post-closure period for compliance with CWA 401 certification conditions. Because many mining projects can be put on hold for long periods of time, it is important that provisions be put in place for stoppages of a significant amount of time.
28. With reference to condition #4, "the application and supporting documents" are for a variety of mine design alternatives. If all of these designs are the basis for this certification, then it is impossible to determine what ADEQ considered the covered activities in its review. If not all of the different designs were used in the review, it is entirely obscure and unclear. Either way, the permit must clearly provide reference for what the covered activities are or are not; otherwise the certification in 5.1 is meaningless.
29. With regard to condition #4, the certification *"does not authorize the discharge of mining, construction,....except as specified in the application and supporting documents..."*. This should not explicitly exclude the heap leach discharges described in the FEIS and original 404 application.

30. ADEQ should consider a mitigation plan that reduces the need to permanently place mine waste materials in WUS. ADEQ should require a closure design that places a significant amount of overburden and waste rock back into the mine pit. This would constitute one of the "...practicable alternatives to the proposed discharge, that is, not discharging into the waters of the U.S..." in accordance with 40 CFR 230(5)(c). Furthermore, the placement of mine waste in WUS may conflict with state surface water quality regulation found in A.A.C. R18-108(D) stating, "A surface water shall not contain solid waste such as refuse, rubbish, demolition or construction debris, trash, garbage, motor vehicles, appliances, or tires." The restrictions on discharge expressed in 40 CFR 230(10)(b)(1) would seem to discourage alternatives that may violate state water quality standards.
31. Backfill of the pit is technically practicable and may be economically feasible, since it has been practiced at other mine sites. This closure design is more frequently being incorporated into mine plans of operation because of more stringent regulations regarding mine pit lakes and water quality impacts, such as in California. Backfill of the pit is a reasonable measure because it offers a rational method to significantly reduce the amount of waste that must be disposed at surface facilities at the proposed mine site. It logically follows that such an approach would lessen impacts in specifically identified areas of concern in the 404B.1 Alternatives analysis and USFS Rosemont FEIS, such as recreation and wilderness, cultural resources, livestock grazing, surface water quantity and quality, and visual resources.
32. Backfilling would reduce the impact to the WUS to an acreage that is much less than the suggested preferred alternative-Barrel Canyon, allow for less impacts to Class IV and V riparian habitat and total riparian habitat, have significantly less reduction in annual down-gradient stormwater flow, and reduce significant environmental impacts overall.
33. With reference to condition #6, ADEQ should participate in the permit coordination committee as envisioned by the Forest Service.

Part 5.2: SPECIFIC CONDITIONS

The following two excerpts are from the draft 401 certification, section 5.2, condition #1. The comments that follow address these two excerpts:

"Within 180 days of the effective date of the CWA 404 permit, the applicant shall submit to ADEQ, for review and approval, a surface water mitigation program designed to maintain aquatic and riparian resources at pre-project levels in Davidson Canyon and Lower Cienega Creek. The program shall include, but is not limited to, a description of measures that will be taken to offset predicted reductions in surface water flow, in response to the project, along with a proposed schedule for implementation. The Final Environmental Impact Statement (FEIS) predicts a 17.2%

reduction in average annual post-closure stormwater runoff volume as a result of the proposed activities. The surface water mitigation program shall describe measures that will offset the reduced runoff volume should it occur.” (p. 5 of 9).

“Within 30 days of ADEQ approval of the program, the applicant shall implement the approved mitigation program in accordance with the schedule set forth in the approved program. Should the results of required monitoring and /or revised hydrologic modeling (FEIS Mitigation Measures FS-BR-22, FS-BR-27, FS-GW-02, FS-SR-05) indicate that water quality in Davidson Canyon or Lower Cienega Creek is adversely affected by the activities certified herein, ADEQ may request that the COE suspend the CWA 404 Permit and require additional mitigation.”

34. We agree that there is a need for a surface water mitigation program to reduce riparian impacts.
35. However, the timeframe provided in condition #1 is too long and sets no expectation for a timeframe for implementation. Please provide a schedule for implementation to lessen the damage caused by the reduced volume.
36. The statement “*should it occur*” should be deleted from condition #1. It is unreasonable to require a demonstration that this impact has occurred before requiring the mitigation. The FEIS analysis predicts with some certainty that it will occur, and Pima County Regional Flood Control District believes the impacts will be greater than predicted in the FEIS. If ADEQ makes the mitigation conditional on proof that harm has occurred, then resource base will diminish for many years unabated before any mitigation begins. This approach would be inconsistent with the Governor’s Executive Orders No. 89-15 on riparian resources and No. 91-6 on protection of riparian areas.
37. The mitigation should consider use of water derived from pit dewatering wells to offset the reduction in annual stormwater runoff during mine operation. The water should be tested for Arizona Surface water quality standards.
38. Regarding water quality, what modeling would prompt suspension of the permit? For water quality, direct monitoring should be required. Also, there needs to be thresholds for water quality that is “adversely affected” in the language of the permit. Cite relevant standards.
39. As written, the intent of the condition #1 seems to be focused on avoiding the 17.2% predicted reduction in post-closure conditions, but the reductions in flow volumes will be greater during the decades of operation. In addition, Pima County has disputed that the FEIS accurately describes the losses in runoff and recharge. Thus, the reference to the 17.2% reduction should be deleted.

40. The public and/or Cooperating Agencies must have an opportunity to review and comment on the draft Surface Water Mitigation Program.
41. We predict that if proof of damage must occur prior to the mitigation, Rosemont Copper's consultants will determine an observed reduction in average annual stormwater runoff volume is due to non-mining effects such as "natural variability" or "prolonged drought conditions", and thereby conclude there is no justification to implement "measures that will be taken to offset predicted reductions in surface water flow". Cooperating Agencies should be provided with an opportunity to review and comment on the monitoring, assessments and hydrologic modeling data which are used to justify these conclusions. We suggest a technical review team of individuals who are not invested in the outcome of such an analysis. Better yet, we recommend making conservative (i.e., erring on the side of caution) assumptions about the amount of water being withheld by the mine and require that amount to be compensated. This makes far more sense than trying to monitor and account for the many factors that can contribute to changes in runoff.
42. If the Surface Water Mitigation Program is to be prepared in response to a predicted reduction in average annual stormwater runoff volume during the post-closure period, then ADEQ should be prepared to specify for what period of time would Rosemont Copper be required to implement "*measures that will be taken to offset predicted reductions in surface water flow*" as part of ADEQ CWA 401 certification requirements. Should a persistent 20% reduction in average annual stormwater runoff volume be observed at the end of a 25-year mining operation (in contrast to the pre-mining average annual stormwater runoff volume), for what period of time would the mitigation measure be in effect?
43. Regarding long-term effects on Davidson Canyon and Lower Cienega Creek due to 401 certified mining activities, please specify whether or how any of the mitigation measures listed below will be utilized to quantify impacts to future downstream water quality specifically attributable to the filling of approximately 40 acres of WUS with tailings, waste rock and miscellaneous fill. As opposed to potential adverse impacts to surface water quality attributable to the entire mine complex related to discharges downstream into Barrel Canyon?
- a. FS-BR-22: Monitoring to determine impacts from pit dewatering on downstream sites (monitor geomorphic changes to Davidson Canyon; surface and ground water monitoring in Davidson Canyon and Lower Cienega Creek);
 - b. FS-BR-27: Validation and rerunning of the groundwater model (every 5 years from pre-mining to five years after closure);
 - c. FS-GW-02: Water quality monitoring beyond point-of-compliance wells (groundwater sampling from wells and springs);

- d. FS-SR-05: Sediment transport modeling upstream of State Route 83 bridge (elevation changes to the channel bed between mine site and bridge).

Part 5.2: STORMWATER MANAGEMENT

- 44. The Mining MSGP coverage described in conditions #2 and #3 is not applicable. The MSGP specifically states that it has no applicability to discharges to Outstanding Arizona Waters (OAW), such as Davidson Canyon, and that “*water quality cannot be lowered in OAWs*”. To quote the MSGP:

“The MSGP Discharging into Outstanding Arizona Waters (Part 1.1.4.6). Per the antidegradation rules, coverage under the MSGP 2010 is not available for new discharges directly to waters designated as outstanding Arizona waters (OAW). ...The applicant must prepare a SWPPP that demonstrates the discharge will not degrade water quality in the OAW and outline basic information that must be included with the SWPP, including a sampling and analysis plan (SAP) for required water quality monitoring”. (p.12 of the MSGP fact sheet).

- 45. Given the presence of an OAW “*exceedance of an Arizona Surface Water Quality Standard*” is not an adequate standard to evaluate whether water quality has been lowered. For example, total dissolved solids (TDS) have relevance for the character of the riparian vegetation and macroinvertebrate communities. Excessive salinities in particular can be damaging and encourage the growth of tamarisk. TDS levels at Oracle Ridge mine monitoring wells and tailings seep have been as high as 1200 mg/l. The Oracle Ridge mine is a skarn deposit similar to the Rosemont mine.
- 46. Given the presence of an OAW, and the requirement for an SWPP and SAP, Pima County requests that ADEQ exercise their authority under ARS 49-202 to request this supplemental information as part of the 401 Certification process.
- 47. With reference to condition #4, please specify what monitoring will be in place to determine if unimpacted stormwater has—or has not—come in contact with mine operations.

Part 5.2: EROSION PREVENTION AND HYDRAULIC ALTERATIONS

- 48. With reference to minimizing exposure of erodible surfaces (Condition #5), this is a very general and unspecific condition. Specifics are needed to prescribe how clearing, grubbing, scraping and erodible surface exposure will be minimized.
- 49. Please define “*excessive erosion*.” It is good to have examples (as noted), but standards are far better; what is considered excessive to one party may not match what excessive means to another. Best to avoid confusion and designate standards.
- 50. We agree with the intent of condition #5. Please work with U. S. Forest Service to reduce the removal of soil from WUS and other erodible surfaces. The Forest Service’s

proposed decision would allow clearing, grubbing, scraping and otherwise exposing erodible surfaces during the “soil salvage” process, a process we believe will remove material that would otherwise attenuate pollutants emanating from the rock surfaces. Their approach is at odds with minimizing exposure of erodible surfaces. By destroying soil integrity and relocating the material onto loose waste rock surfaces, the erodibility of the material will be enhanced.

51. The 401 application also references that *“the ground will be cleared and grubbed in an upgradient, or westerly direction, generally followed by placement of the finger drains and other flow-through drains”*. This approach is also at odds with condition #5.
52. Condition #6 needs to describe measures that can and will be used to control erosion, including rock weirs, waddles, straw bales, and other tools.
53. Harmful or toxic substances need definition as per Arizona State Revised Statutes. For example: as per ARS49-301.38.
54. With reference to condition #6, the referenced documents would support a conclusion that harmful or toxic substances would be discharged into streams. This certification cannot be offered until and unless the applicant offers a basis for meeting this condition.
55. Condition #7: Which *“erosion control, sediment control and/or bank protections measures”* are being referenced? Those in which FEIS alternative or permit application? They all differ.
56. Condition #8: please specify who shall re-evaluate the effectiveness of pollution control measures, and by when. Pima County suggests that the permittee provide ADEQ with a quarterly report of its evaluations and repairs/modifications in response to this condition.
57. Condition #8: The language: *“The effectiveness of all pollution control measures, including those preventing erosion and affecting sedimentation, shall be reevaluated after each flow event and repaired/modified as needed”* needs to be modified. Per information contained in the draft 2013 SWPPP, there are now three Compliance Point Dams (Sediment Control Structures) which “will serve as the final sediment traps for stormwater runoff from the Project and where stormwater quality will be monitored and tested, i.e. outfalls.” This is another example of inconsistent information provided by the applicant. This certification is premature and should be denied.
58. Also, as described within the Record of Decision (ROD) and the FEIS, stormwater runoff from large storm events may regularly overtop and destroy the compliance point dams due to their relatively small capacity of 2 acre-feet. These “large” storm events would likely also be carrying the most amount of sediment from the mine site for discharge into downstream drainages. Will sediment releases due to overtopping and/or failure of

the Compliance Point Dams continue until such time ADEQ determines “subsequent discharges will meet Arizona Surface Water Quality Standards” (draft ROD, p. A-13)?

59. Condition #10 is very general. Specificity is needed such as: Fill used to support vegetation rooting shall be protected from erosion by anchoring with materials such as straw, mulch, hydro-seed and other material. Slopes shall be reduced to impede runoff and erosion.
60. Condition #12: Pima County has a number of concerns about the adequacy of the compliance point dam. Cooperating agencies have commented on the potential for unregulated discharge of stormwater that has been in contact with ore bodies and mine processing facilities in the event that the compliance point dam is overtopped and destroyed, which could happen with some frequency. The stormwater reaching the compliance point dam is not halted or permanently retained by the dam in any way and will flow downstream in any case. The dam allows for some settling of sediment, detains stormwater temporarily, and allows for a convenient location to collect stormwater samples. The dam does not, however, prevent stormwater from flowing downstream.
61. Conditions #11 & 12 reference the need for detention/retention structures. These are required to ‘cause no significant change to the hydraulic conditions downstream...’ However, the very purpose of detention/retention structures is to change hydraulic conditions downstream. Instead, we recommend they be built to mimic pre-mine hydrology, hydraulics and sediment transport regimes.
62. On denuded areas, revegetation efforts need a performance standard to be met. Stating revegetation gives the applicant no standards to meet. Baseline vegetation needs density evaluation in the proposed denuded areas and at a minimum a performance standard is needed to meet for density and time to restore.
63. Condition #15 is at odds with the applicant’s intention that compliance dams will be unstabilized. The dams will induce sedimentation and will be repeatedly eroded and rebuilt. The areas around the compliance dams will not be vegetated.
64. Condition #15: If there can be no alteration of flow in the impacted WUS, this would require that Rosemont provide greater details about the chronology and location of impacts to WUS on the project site. We have not seen such a document. This is important, because especially early in the mine’s development there will be impacted areas that will be severely altered because any erosion control structures are in place. (At least this is all we can infer from the documents from Rosemont.)
65. In order to ensure that there is no adverse change in stability with respect to stream hydraulics, ADEQ must require the applicant to establish and document pre-project conditions on the WUS for stream slopes, meander values, roughness, hydraulic radii, and other baseline values, otherwise condition #17 is meaningless.

Part 5.2: SEDIMENT LOADS

66. Condition #17 says that *“the applicant shall ensure no adverse change, due to the subject project, has occurred in the stability with respect to stream hydraulics, erosion and sediment load, of any WUS including downstream from the project.”* How will stability be defined and how will erosion and sediment load be monitored? We suggest including very specific thresholds.
67. We agree with the need to monitor sediment load, but believe conditions #18 to #20 require further specificity to be enforceable. In addition, a monitoring frequency and protocol should be referenced.
68. Condition #18 describing *“flow in any WUS is sufficient to erode, carry or deposit material”* should be modified to a specified flow (peak discharge or erosive velocity). Sediment movement and deposition occur in virtually all channels (even concrete lined ones).
69. Condition #19 references a comparison with *“natural background levels of sediment.”* Have these measures of silt content or turbidity been determined? If so, they should be cited. If not, there should be a requirement to provide a method to determine what these are.

Part 5.2: POLLUTION PREVENTION

70. With regard to the protection of Outstanding Waters of Arizona (OAWs), the FEIS (page 548) states that Rosemont Copper has not completed its demonstration to the State of Arizona that discharges from the proposed Rosemont Mine will not degrade existing water quality in the downstream OAWs. No analysis is presented in that document for the degradation of water quality for the OAWs, only Barrel Canyon.
71. ADEQ should evaluate of the assimilative capacity of Barrel Canyon or Davidson Canyon to absorb the pollutants emitted from the mine.
72. Has ADEQ independently concluded that the OAWs will not be affected? If so, what is the basis?
73. The FEIS offers contradictory statements about the effects to Barrel Canyon. In one place (page 663) that there will be no “exceedances of surface water quality standards that are not already exceeded in natural runoff in Barrel Canyon are expected from the proposed mine operations”. In another place (page 474), the FEIS says that “predicted runoff water quality from waste rock and soil cover meets surface water quality standards in Barrel Canyon”.
74. The baseline characterization of water quality in both Barrel Canyon and Davidson Canyon, as described in the SWCA (2013) report, is inadequate for the purposes of this certification. The water quality data presented in the FEIS provide evidence that ambient stormwater runoff in Barrel Canyon is elevated in metals. Pima County does

not understand how activities proposed can meet condition #21 of this permit. Total loading will be increased by dredging of top soil and filling with waste rock contemplated under this permit.

75. Furthermore, there is a likelihood of harm because the facility design relies on methods of stormwater control that direct surface waters into fractured bedrock aquifers that discharge to springs and seeps in the area. Also, the waste rock and tailings facilities will be placed on a surface from which topsoil and surficial rock (regolith) has been stripped for later use in reclamation. The removal of soil and regolith reduces opportunities for pollutant attenuation. The mixture of runoff and mine drainage will flow over a fractured bedrock surface. There is no liner to prevent infiltration into the fracture bedrock aquifer and there is no evaporation once the water infiltrates.
76. Subsurface discharge from the mine can enter a fractured bedrock aquifer that has springs and seeps as its surface discharge points. Springflow that supports aquatic and wildlife use is a down-gradient use in Barrel Canyon and at other area streams and springs. A.A.C. R18-11-405(B) states, "A discharge shall not cause or contribute to a violation of a water quality standard established for a navigable water of the state." Therefore, include in this permit a requirement to monitor at the aquifer points of compliance (POCs) for selenium, copper, arsenic, and mercury; set alert levels based on surface water quality standards for aquatic and wildlife (warm water).
77. There is also a likelihood of harm because the 404 application allows waste rock on top of Rosemont Spring and tailings near McCleary Spring. Both of these are located in WUS. Existing surface water uses and standards will be impaired at these sites, both physically and chemically.
78. The boilerplate language in condition #22 does not appear to be developed with reference to this mine proposal.
79. Condition #22 appears to be internally inconsistent as it prohibits pollutants in fill, but allows uses of mining residues including waste rock, gangue and tailings which, on the basis of referenced documents, contain pollutants that will contribute to degradation of water quality.
80. For condition #23, it is not clear what materials and techniques Rosemont is employing while they are working in WUS. This should be made clear. This permit should be conditioned on a sampling of source waters from the temporary and permanent water bodies created by the discharge of dredge or fill. Characterization of the water in these waterbodies is needed in order for ADEQ to know what constituents to sample for in downstream waters. Source sampling must be completed to characterize the potential pollutants associated with mine runoff.
81. The purpose of some of the proposed fill is to create new ponds to detain or retain stormwater. The permit should be conditioned upon monitoring to assure these water

bodies meet narrative and quantitative surface water standards. Some of these new water bodies will be in contact with tailings and wasterock, therefore are surface water impoundments that must be regulated through application of state surface water quality standards. Therefore, include periodic monitoring of narrative and quantitative water quality at planned surface waters.

82. We would predict that the waste and tailings will inadvertently create unplanned surface water bodies around the perimeter of the site where natural flows are blocked or where drainage collects. The permit should be conditioned upon quarterly or more frequent visual surveys for unplanned surface water bodies.
83. Therefore, please include conditions for monitoring narrative and quantitative surface water quality standards for Aquatic and Wildlife at the locations of unplanned surface water bodies, to include arsenic, selenium, copper and mercury.
84. Include annual reporting of the location of new surface water bodies, and observed conditions to ADEQ and share this information with the interagency permitting committee proposed by the Forest Service.
85. The pit lake that would be created by this permit would have a volume of 96,000 acre-feet, making it one of the largest water bodies in southern Arizona. The pit lake would be accessible to wildlife. The APP provides no monitoring for the pit lake. This permit should be conditioned upon post-mining surface water quality monitoring to assess potential toxicity to wildlife. The pit lake must meet water quality standards for Aquatic and Wildlife (warm water or cold water as temperature dictates) for arsenic, selenium, copper and mercury.
86. We agree with SWCA's (2013; memorandum from Chris Garrett entitled "Revised Analysis of Surface Water Quality"; cited in the FEIS) conclusion that "*stormwater quality appears never to have been sampled in Davidson Canyon*". Such would require special sampling equipment to be installed.
87. This permit should require baseflows in the Davidson Canyon OAW reach to be monitored for aquatic and wildlife standards, not just stormwater. Base flow volume and quality are critical parameters to wildlife.
88. The OAWs are located on County and District lands. We ask that ADEQ recognize our authority to permit and condition access to our lands and waters. Recently, Rosemont submitted to ASLD an application to site groundwater and surface water quality sampling devices on State Trust land at Davidson Canyon; we advise ADEQ that this sampling site is not located on the Davidson OAW.

Part 5.2: TEMPORARY AND PERMANENT STRUCTURES

89. Permanent structures should be sized to accommodate at least the 100-yr flow.

Condition #29 states that 'Permanent pipes, temporary pipes, and culvert crossings be

adequately sized to handle the expected flow.’ Rosemont is left to estimate what ‘adequate’ is, and the people of Arizona are left to accept this assessment. Standard engineering practice is to identify a flow and design accordingly. Without specifying what this flow is, there is no assurance it can handle flows of concern to the people of Arizona. Pima County has determined that the methods used to determine flows in the FEIS are not adequately conservative or accurate to be used to size structures.

ATTACHMENT 1

Stable Isotope Tracers Reveal Flow Paths of Tucson Basin Groundwater

By Christopher Eastoe, Research Scientist, Ailiang Gu, Graduate Student,
and Austin Long, Emeritus Professor

For many years, Tucson depended entirely on groundwater pumped from the regional aquifer in the Tucson basin and neighboring Avra Valley for a water supply. The Tucson basin is typical of the Basin and Range province in containing thousands of meters of sediment derived from the surrounding hard-rock ranges. Predominantly sand and gravel in the upper few hundred meters of the basin have been the principal source of water. The basin groundwater is replenished from streams that drain areas of high rainfall (relative to rainfall in the basin itself) in the mountains to the north and east, and in the uplands towards the Mexican border.

Colorado River water now supplements the city's water supply, and the pumping of groundwater is now greatly reduced under central Tucson. The city is growing unabated, nonetheless, and groundwater will continue to be a crucial water resource. Future exploitation of the aquifer will necessitate a better understanding of the ages, origins, and flow paths of the groundwater as basic information for the construction of groundwater flow models. It is difficult to locate zones of recharge at the surface, and even more difficult to track the movement of concealed groundwater. An essential first step towards understanding water movement is the construction of a map of static water levels. Using data from the hundreds of wells in the Tucson basin, such a map was assembled in the late 1990s (see www.ag.arizona.edu/AZWATER/publications/sustainability/index.html, Fig. 3.2).

Isotope studies provide additional information revealing the complexity of the recharge process. Stable oxygen and hydrogen isotopes label the water molecule itself, and their ratios vary as a function of condensation temperature during precipitation, evaporation, and water-rock interaction. These ratios can be used to distinguish waters of different origin — in the Tucson basin, for example, rain or snow from the surrounding high mountains can be distinguished from rain at the basin floor — and to detect mixing between waters of different origin. Isotopes in sulfate and bicarbonate ions provide information on sources of solutes. In Tucson, sulfur isotopes are useful because of the isotopic contrast between Permian (~250 million years ago) marine gypsum that is present to the southeast, and other sulfate sources in soil or sediment that represent a combination of sulfur from igneous rocks and dust. Natural radioactive isotopes such as tritium and radiocarbon provide information about the age of groundwater.

Over the last 20 years, the Laboratory of Isotope Geochemistry has assembled an isotope data set for hundreds of sample sites in Tucson, and for almost every measurable rain event. Past graduate students — notably Bob Kalin, Sofie Pasilis, Joy Gillick, John Lindquist, David Esposito, and Erin Cunningham — have constructed portions of the maps of O, H, S, and C isotopes. Recently, we have completed coverage of the central part of the basin. Much of the work was supported by our publicly-funded Laboratory as a service to the community; more

recently, the University and the SAHRA Science and Technology Center have supported us.

In this brief article, we present an interpretation of our S and O isotope results in the central part of the basin (Fig. 1).

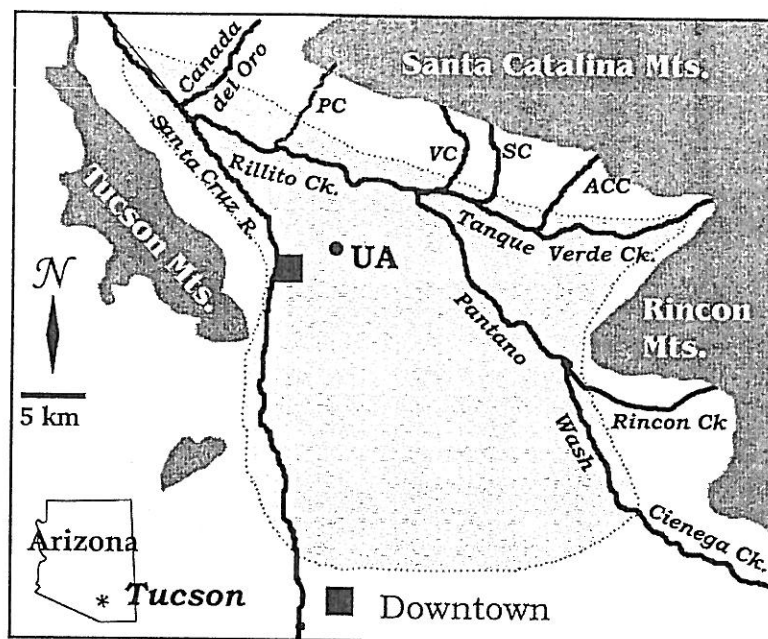


Figure 1. Location map of study area (patterned), showing major streams of the Tucson basin: PC = Pima Creek, VC = Ventana Creek, SC = Sabino Creek, ACC = Agua Caliente Creek.

Delta Notation and Isotope Fractionation

Using mass spectrometers, we measure isotope ratios R , e.g.

$$R = {}^{18}\text{O}/{}^{16}\text{O}, \text{ or } {}^{34}\text{S}/{}^{32}\text{S}$$

Using R values for samples, and for standard materials (VSMOW, a seawater standard, for O; and CDT, a meteoritic sulfide standard, for S), we define delta values as follows:

$$\delta^{18}\text{O} = [(R_{\text{sample}}/R_{\text{standard}}) - 1] \times 1000 \text{ ‰ (per mil)}; \text{ likewise } \delta^{34}\text{S}.$$

Evaporation of water enriches ${}^{16}\text{O}$ in the vapor relative to the composition of the liquid water. Such a separation of isotopes is termed fractionation. Condensation does not generally reverse this process completely, so that average rain in most places is enriched in ${}^{16}\text{O}$ relative to 0‰ seawater. Average rainwater and groundwater therefore have negative $\delta^{18}\text{O}$ values.

Isotopes in Tucson Basin Groundwater

We possess $\delta^{18}\text{O}$ data for groundwater from more than 300 sites, and $\delta^{34}\text{S}$ data for dissolved sulfate from 137 sample sites. A complete list of the data and isotope ...cont'd page 8

Tucson Basin Groundwater *cont'd...*

distribution maps can be found on the Internet at www.geo.arizona.edu/researchers/mbaker/AustinLong/.

As a working hypothesis, we proposed that most water in the upper part of the regional aquifer derives ultimately from the major streams that enter the basin. If the water in each stream has a characteristic isotope signature, and if a similar distinctive signature is found in part of the aquifer, then we may be able to infer that the stream is the main water source for that area.

Stream water could be sampled at the surface during flow events, but this approach yields a broad range of $\delta^{18}\text{O}$ values reflecting the isotopic variability of rainwater. A better estimate of the average isotopic content of water available to replenish the regional aquifer from each stream is obtained from shallow wells in the flood plain. Fig. 2 shows $\delta^{34}\text{S}$ and $\delta^{18}\text{O}$ data of flood plain ground-water. Several distinctions can be made — between Cienega Creek and the other streams on the basis of $\delta^{34}\text{S}$, and between Rincon Creek and the Santa Cruz River on the basis of $\delta^{18}\text{O}$. The empty ellipse corresponds to a water composition not known from the major flood plains.

The $\delta^{18}\text{O}$ and $\delta^{34}\text{S}$ distribution maps (see website) show basin-scale features with boundaries that do not coincide. The existence of large map features argues for the importance of recharge from basin-scale sources such as the major streams. The major feature of the $\delta^{18}\text{O}$ map is a boundary, near Interstate 10, between mountain-derived water with $\delta^{18}\text{O} < -9\text{‰}$ to the northeast, and basin-derived water with $\delta^{18}\text{O} > -8\text{‰}$ to the southwest. On the $\delta^{34}\text{S}$ map, the major feature is a plume of sulfate-rich water with $\delta^{34}\text{S} > 10\text{‰}$, derived ultimately from Permian gypsum, that extends across the basin from southeast to northwest. Surrounding water contains sulfate with $\delta^{34}\text{S} < 10\text{‰}$.

We can divide the basin map into domains using the $\delta^{18}\text{O}$ and $\delta^{34}\text{S}$ boundaries together (Fig. 3). Each domain contains water

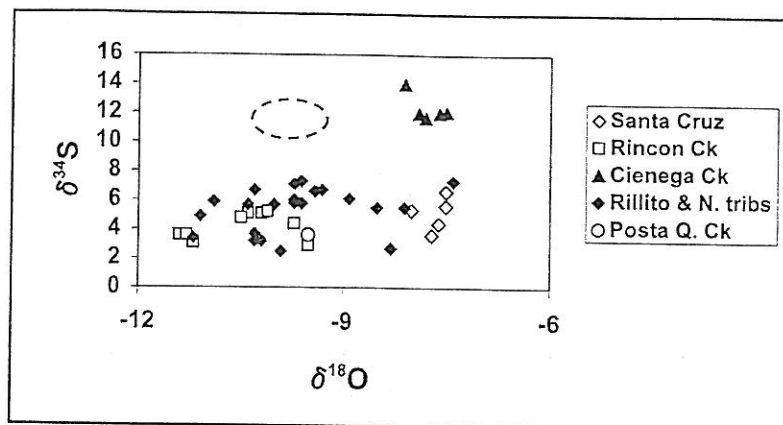


Figure 2. Plot of $\delta^{34}\text{S}$ vs. $\delta^{18}\text{O}$ in flood plain groundwater. The empty ellipse corresponds to groundwater compositions not represented in flood-plain groundwater.

with a characteristic combination of $\delta^{18}\text{O}$ and $\delta^{34}\text{S}$. Between domains C and D, the boundary is defined by a change in $\delta^{18}\text{O}$; between domains B and C, the boundary is defined by changes in $\delta^{34}\text{S}$. The domains match the major streams as follows:

Domain A, with $\delta^{18}\text{O} < -9\text{‰}$ and $\delta^{34}\text{S} < 10\text{‰}$, corresponds to water from Rillito and Tanque Verde Creeks and their northern tributaries.

Domain B, with $\delta^{18}\text{O} > -8\text{‰}$ and $\delta^{34}\text{S} < 10\text{‰}$, corresponds to water from the Santa Cruz River.

Domain C, with $\delta^{18}\text{O} > -8\text{‰}$ and $\delta^{34}\text{S} > 10\text{‰}$, contains water that matches flood plain groundwater from Cienega Creek.

Domain D, with $\delta^{18}\text{O} < -9\text{‰}$ and $\delta^{34}\text{S} > 10\text{‰}$, matches the empty ellipse in Fig. 2.

Domain E, with $\delta^{18}\text{O} < -10\text{‰}$ and $\delta^{34}\text{S} < 10\text{‰}$, corresponds to Rincon Creek.

Domain F has $\delta^{18}\text{O} > -8\text{‰}$ and $\delta^{34}\text{S} < 10\text{‰}$ like domain B, but is remote from the Santa Cruz River.

The domain map tells us a great deal about the origin of groundwater in different areas of the Tucson basin. For a domain having clear geographic and isotopic relationships with a specific stream, we deduce that the stream is the source of the groundwater. Domain C does not appear to be continuous at the southeastern end; all attempts to find samples to bridge the gap have failed so far. The water in this domain is following one or more Pleistocene courses of Cienega Creek, which has not always followed the present course into Pantano Wash. The water in Domain D must have originated at high elevation, probably in the Rincon Mountains, but has a Permian sulfate S-isotope signature. It appears to be upwelling in the southeastern corner of the basin, possibly dissolving gypsum at depth in the basin-fill sediments. Oligocene lacustrine gypsum, reworked from Permian strata, crops out in sediment closer to the southeastern edge of the basin.

Isotope maps showing the distribution of tritium and radiocarbon in groundwater (see website) help to confirm the domain boundaries established by S and O isotopes, and provide much additional information about the age of the groundwater. But that is a story for another time!

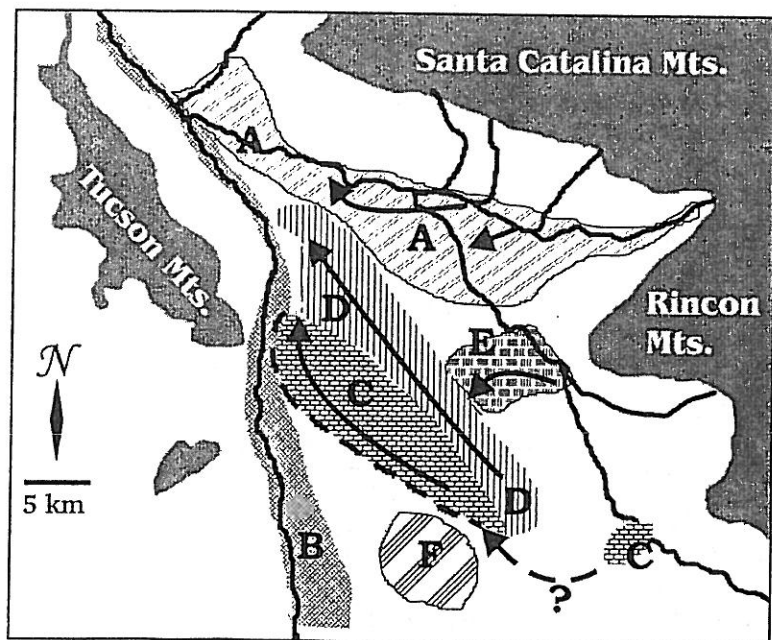


Figure 3. Map of Tucson basin showing groundwater isotope domains and flow directions. Domain designations are explained in the text.

ATTACHMENT 2



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Technical Memorandum

To:	Kathy Arnold	From:	David Krizek
Company:	Rosemont Copper Company	Date:	August 23, 2010
Re:	Rosemont APP-Regulated Facility Depth to Groundwater	Doc #:	228/10-320877-5.3
CC:	Karen Schwab (Kimberlite)		

1.0 Introduction

This Technical Memorandum provides estimated depth to groundwater from existing ground and/or facility bottom elevations based on the updated locations (July 2010) of those facilities regulated under the Aquifer Protection Permit (APP) program at the proposed Rosemont Copper Project (Project) in Pima County, Arizona. Updated APP-regulated facilities were highlighted in the Technical Memorandum titled *Rosemont APP-Regulated Facility Locations* dated August 18, 2010 (Tetra Tech, 2010). Depth to groundwater estimated were based on well locations shown on a figure titled *Well and Spring Locations - Rosemont Area* by Errol L. Montgomery & Associates, Inc. dated May 19, 2009 and a summary excel table of groundwater level measurements titled *RosemontManualDataMaster_Jun 2010_Grazing Area* provided by Rosemont Copper Company (Rosemont).

This information is provided in response to the April 14, 2010 Comprehensive Request for Additional Information from the Arizona Department of Environmental Quality (ADEQ) to Rosemont Copper Company (Rosemont). Specifically, this Technical Memorandum answers item no. 34 on page 14 of 18.

- *Please develop a table of groundwater elevation and elevation (bottom) of the above-lying APP facility indicating estimated depth to groundwater at or in the vicinity of the facility footprint.*

2.0 APP-Regulated Facility Locations (updated locations)

Figures 04A and 05A in Attachment 1 show the current locations of the APP-regulated facilities as of the end of July 2010. These figures are from the August 18, 2010 Technical Memorandum and highlight the APP-regulated facilities (generally permitted and area-wide permitted) along with the non-discharging and other exempt facilities. Table 1 provides coordinates for the APP-regulated facilities. Figures 04A and 05A also show existing ground contours (50' contour interval shown).

Table 1 Updated Location of APP Regulated Facilities (revised Table 2.01 from February 2009 APP application)

Facility Name	Facility Type (A.R.S. §49-241(B))	Latitude (UTM NAD 83 Northing - ft)	Longitude (UTM NAD 83 Easting - ft)	Cadastral		
				T	R	S
General Permit Facilities (not included in Area-wide APP)						
Coarse Ore Stockpile	Intermediate Ore Stockpile	31° 50' 24.91" (11,557,577.22)	110° 44' 56.31" (1,718,342.14)	18S	16E	30
Temporary Run-of-Mine (ROM) Ore Stockpiles	Intermediate Ore Stockpile	31° 49' 57.59" (11,554,817.82)	110° 44' 52.69" (1,718,660.91)	18S	16E	30
Sewage Treatment Facilities	Septic Tanks and Leach Fields	Various locations in Plant Site	Various locations in Plant Site	18S	16E	30
Area-wide APP Facilities						
Dry Stack Tailings Facilities	Tailings	31° 50' 18.52" (11,556,944.78)	110° 43' 51.40" (1,723,940.74)	18S	16E	29
Process Water Temporary Storage Pond (TS Pond)	Non-Stormwater Pond	31° 50' 9.80" (11,556,056.78)	110° 44' 27.39" (1,720,839.83)	18S	16E	30
Primary Settling Basin	Non-Stormwater Pond	31° 50' 23.78" (11,557,468.36)	110° 44' 28.51" (1,720,739.47)	18S	16E	30
Raffinate Pond	Process Solution Pond	31° 50' 15.09" (11,556,589.72)	110° 44' 35.99" (1,720,096.29)	18S	16E	30
Heap Leach Pad	Heap Leach Pad	31° 49' 23.93" (11,551,418.85)	110° 44' 48.37" (1,719,041.03)	18S	16E	31, 32
PLS Pond	Process Solution Pond	31° 49' 32.20" (11,552,261.31)	110° 44' 12.44" (1,722,137.55)	18S	16E	32
Stormwater Pond	Non-Stormwater Pond	31° 49' 35.98" (11,552,644.27)	110° 44' 9.32" (1,722,406.21)	18S	16E	32
Open Pit	Open Pit Mine	31° 49' 56.84" (11,554,736.44)	110° 45' 22.91" (1,716,054.54)	18S	16E, 15E	30, 31 25, 36
Waste Rock Storage Area	Waste Rock Dump	31° 48' 56.20" (11,548,622.88)	110° 44' 26.22" (1,720,958.50)	18S 19S	16E 16E	31, 32 05, 06
Waste Management Area	Solid Waste Facility	31° 50' 34.13" (11,558,506.91)	110° 45' 4.04" (1,717,673.68)	18S	16E	30

Note: Partial sections may not be shown for Dry Stack Tailings Facility and Waste Rock Storage Area.

There will be several sewage treatment facilities within the Plant Site area (generally permitted). These treatment facility locations are anticipated to be the following:

- **ND-PS-04:** Septic leach field by the Primary Crusher (ND-PS-01)
- **ND-PS-04:** Septic leach field by the SX-EW Building (ND-PS-13)
- **ND-PS-04:** Septic leach field by the Mine Truck Shop (ND-PS-15)
- **ND-PS-04:** Septic leach field by the Change House (ND-PS-20)
- **ND-PS-04:** Septic leach field by the Main Warehouse (ND-PS-21)
- **ND-PS-04:** Septic leach field by the Analytical Laboratory (ND-PS-22)
- **ND-PS-04:** Septic leach field by the Administration Building (ND-PS-23)

The assumed coordinates of these sewage treatment facilities are shown in Table 2.

Table 2 Updated Location of Sewage Treatment Facilities

Facility Name	Facility Type (A.R.S. §49-241(B))	Latitude (UTM NAD 83 Northing - ft)	Longitude (UTM NAD 83 Easting - ft)	Cadastral		
				T	R	S
General Permit Facilities (not included in Area-wide APP)						
Primary Crusher location	Septic Tanks and Leach Fields	31° 49' 57.30" (11,554,790.76)	110° 44' 45.17" (1,719,309.46)	18S	16E	30
SX-EW Building location	Septic Tanks and Leach Fields	31° 50' 16.58" (11,556,739.44)	110° 44' 40.64" (1,719,695.14)	18S	16E	30
Mine Truck Shop location	Septic Tanks and Leach Fields	31° 50' 6.97" (11,555,767.92)	110° 44' 41.86" (1,719,592.07)	18S	16E	30
Change House location	Septic Tanks and Leach Fields	31° 50' 37.35" (11,558,836.95)	110° 44' 41.91" (1,719,581.20)	18S	16E	30
Main Warehouse location	Septic Tanks and Leach Fields	31° 50' 26.09" (11,557,699.94)	110° 44' 39.87" (1,719,759.35)	18S	16E	30
Analytical Laboratory location	Septic Tanks and Leach Fields	31° 50' 23.97" (11,557,483.58)	110° 44' 52.04" (1,718,710.90)	18S	16E	30
Administration Building location	Septic Tanks and Leach Fields	31° 50' 31.83" (11,558,281.97)	110° 44' 28.64" (1,720,726.81)	18S	16E	30

3.0 Depth to Groundwater (APP-Regulated Facilities)

Table 3 provides the estimated depth to groundwater in the area of each APP-regulated facility. The estimated depths to groundwater shown in Table 3 were interpolated from the well data indicated in Section 1.0 based on the depth to groundwater at the nearest well location to a APP-regulated facility. The basis of the estimated depth to groundwater, i.e., the well name, is also shown in Table 3.

Table 3 Estimated Depth to Groundwater

Facility Number	APP-Regulated Facility Name	Estimated Existing Ground/Facility Bottom/Pad Elevation (ft amsl)	Estimated Groundwater Elevation Range (ft)	Approximate Estimated (Est.) Depth to Groundwater (ft)
AR-GP-01	Coarse Ore Stockpile	5,120' (ground) 5,100' (pad)	4,785' – 5,149' (Plant Site area)	20' (est.)
AR-GP-02	Temporary ROM Ore Stockpile	5,100' (ground) 5,050' (pad)	4,785' – 5,149' (Plant Site area)	20' (est.)
AR-GP-03	Sewage Treatment Facilities			
	Primary Crusher	5,020' (ground) 5,050' (pad)	4,785' – 5,149' (Plant Site area)	20' (est.)
	SX-EW Building	5,020' (ground) 5,039' (lower pad)	4,785' – 5,149' (Plant Site area)	20' (est.)
	Mine Truck Shop	5,030' (ground) 5,020' (pad)	4,785' – 5,149' (Plant Site Area)	20 (est.)
	Change House	5,020' (ground) 4989 (pad)	4,785' – 5,149' (Plant Site Area)	20' (est.)
	Main Warehouse	4,980' (ground) 4,995' (pad)	4,785' – 5,149' (Plant Site Area)	20' (est.)
	Analytical Laboratory	5,100' (ground) 5,090' (pad)	4,785' – 5,149' (Plant Site area)	20' (est.)
	Administration Building	4,980' (ground) 4,980' (pad)	4,785' – 5,149' (Plant Site area)	20' (est.)

Facility Number	APP-Regulated Facility Name	Estimated Existing Ground/Facility Bottom/Pad Elevation (ft amsl)	Estimated Groundwater Elevation Range (ft)	Approximate Estimated (Est.) Depth to Groundwater (ft)
AR-TF-01	Dry Stack Tailings Facility	4,770' (ground at center coordinate)	4,499' – 4,816'	30' at center coordinate point (est.)
AR-PS-01	PWTS Pond (PW Pond)	4,900' (ground) 4,892' (bottom)	4,785' – 5,149' (Plant Site area)	20' (est.)
AR-PS-02	Waste Management Area	5,280' (ground)	4,785' – 5,149' (Plant Site area)	130' (est.)
AR-PS-03	Primary Settling Basin	4,920' (ground) 4,913' (bottom)	4,785' – 5,149' (Plant Site area)	20' (est.)
AR-HL-01	Raffinate Pond	4,900' (ground at center coordinate) 4962' (bottom) ¹ (4,969' new location) ²	4,785' – 5,149' (Plant Site area)	160' (est.)
AR-HL-02	Heap Leach Pads	5,150' (ground at center coordinate) 5,143 (pad at center coordinate) ¹	4,730' – 5,057'	100' at center coordinate point (est.)
AR-HL-03	PLS Pond	4880 (ground at center coordinate) 4,870' (bottom) ¹	4,730' – 4,818' 4,795' (ave)	45' (est.)
AR-HL-04	Stormwater Pond	4870 (ground at center coordinate) 4,870' (bottom) ¹	4,730' – 4,818' 4,795' (ave)	45' (est.)
AR-OP-01	Open Pit	5,140' (ground at center coordinate)	5,046' – 5,196'	45' at center coordinate point (est.)
AR-WR-01	Waste Rock Storage Area	4,990' (ground at center coordinate)	4,730' – 5,034'	45' at center coordinate point (est.)

¹Based on May 2009 permit level design of Heap Leach Facility

²Location shown on Figures 04A and 05A



REFERENCES

Tetra Tech (2009). *Aquifer Protection Permit (APP) Application*. Prepared for Rosemont Copper Company. Report dated February 2009.

Tetra Tech, Barrios, F.; Chee, R. (2010). *Rosemont APP-Regulated Facility Locations*. Technical Memorandum to Kathy Arnold (Rosemont Copper Company). Technical Memorandum dated August 18, 2010.

Errol L. Montgomery & Associates, Inc. (2009). *Well Spring Locations Rosemont Area*. Figure 1 to Rosemont Copper dated (May 19, 2009).

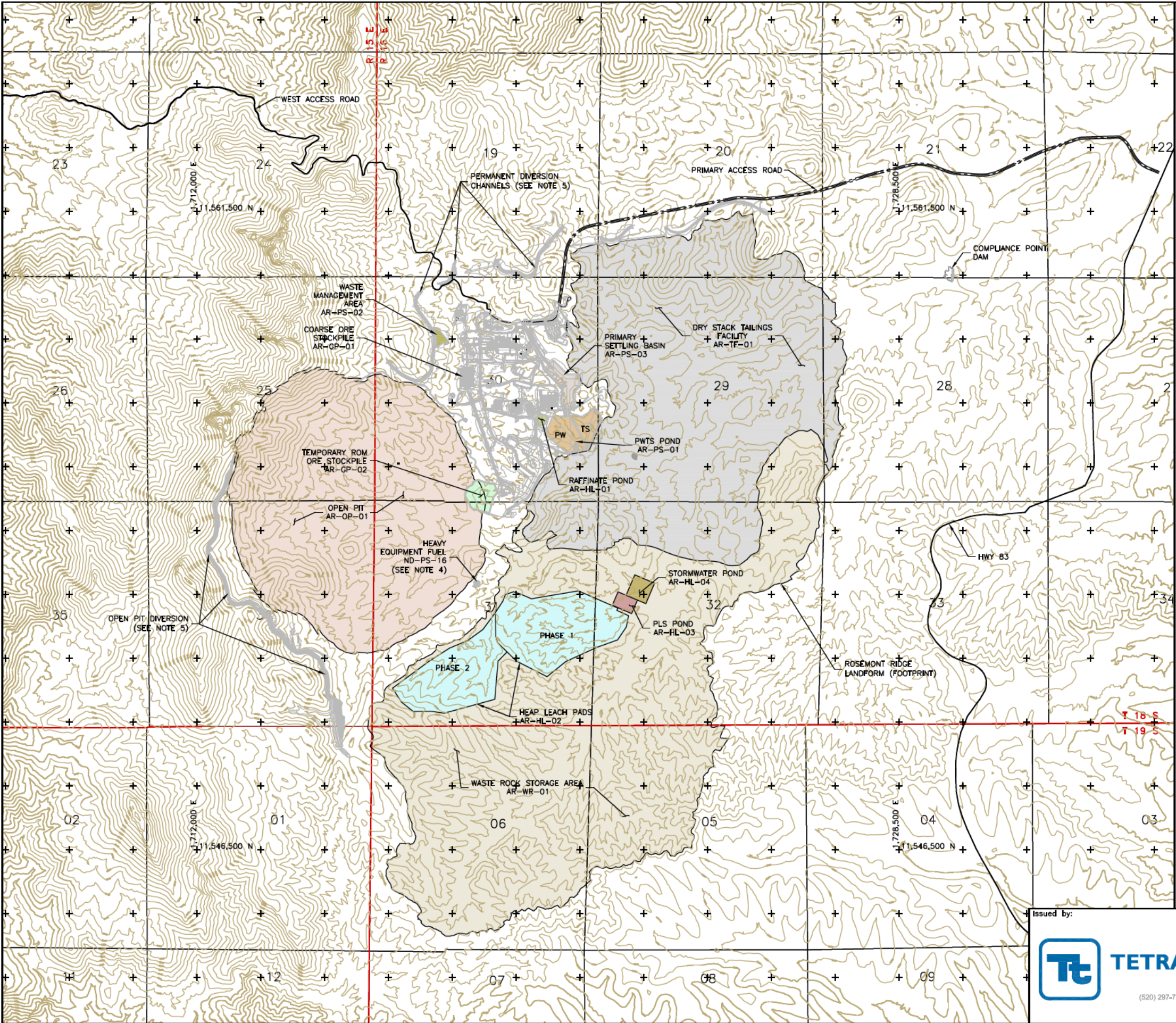
Rosemont Copper Company, (2010). *RosemontManualDataMaster_Jun2010_Grazing Area*. Excel Table to Tetra Tech dated June, 2010.

ATTACHMENT 1

Updated APP-Regulated Facility Locations

Figure 04A

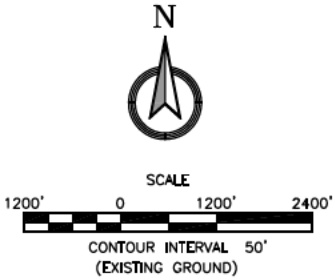
Figure 05A




LEGEND
=== PROPOSED ROAD
— EXISTING PAVED ROAD
— SECTION BOUNDARIES
— TOWNSHIP & RANGE BOUNDARIES
+ UTM NAD 83 GRID COORDINATES

APP REGULATED FACILITIES
AR-TF-01 Dry Stack Tailings Facility (Phase 1 & Phase 2)
AR-PS-01 Process Water Temporary Storage - PWTS Pond (PW Pond only)
AR-HL-01 Raffinate Pond
AR-HL-02 Heap Leach Pads
AR-HL-03 PLS Pond
AR-HL-04 Stormwater Pond
AR-OP-01 Open Pit
AR-WR-01 Waste Rock Storage Area
AR-PS-02 Waste Management Area
AR-PS-03 Primary Settling Basin
AR-GP-01 Coarse Ore Stockpile
AR-GP-02 Temporary ROM Ore Stockpile
AR-GP-03 Sewage Treatment Facilities (See note 1)

- AR - APP Regulated Facilities
CF - Closed Facilities
EX - Exempt Facilities
GP - Generally Permitted
HL - Heap Leach
ND - Non-Discharging
OP - Open Pit
PS - Plant Site
SW - Stormwater
TF - Tailings Facility
WR - Waste Rock
- NOTES:**
1. ALL APP REGULATED FACILITIES, EXCEPT THE SEWAGE TREATMENT FACILITIES LOCATED AT THE PLANT SITE, ARE INDICATED ON THIS FIGURE. THE PLANT SITE FACILITIES ARE SHOWN ON FIGURE 05A.
2. TEMPORARY DIVERSIONS (GP-SW-07) WILL BE UTILIZED ON AS A NEEDED BASIS AS DETERMINED BY FIELD CONDITIONS IN ORDER TO PROTECT FACILITIES.
3. LAYOUT BASED ON JULY 2010 PLANT SITE FACILITY LOCATIONS AND PHASED TAILINGS ALTERNATIVE FOR ROSEMONT RIDGE LANDFORM.
4. THE HEAVY EQUIPMENT FUEL STORAGE AND DISPENSING FACILITY (NON-DISCHARGING/NON-APP REGULATED) IS ALSO SHOWN ON THIS FIGURE FOR CLARITY.
5. SEE FIGURE 04B AND 04A FOR STORMWATER MANAGEMENT FEATURES.



Issued by:
 **TETRA TECH**
3031 West Ina Road
Tucson, Arizona 85741
(520) 297-7723 (520) 297-7724 fax

Title:
APP REGULATED FACILITY LOCATIONS


Project:
ROSEMONT COPPER PROJECT

Location:
PIMA COUNTY, ARIZONA

Project no.:
320877

Date:
08/10

Figure no.:
04A


REVISION

From: Greczmiel, Horst <[REDACTED]>
Sent: Wednesday, February 26, 2014 6:21:23 AM
To: [REDACTED]

Horst Greczmiel
Associate Director for NEPA Oversight
Council on Environmental Quality

[REDACTED]

P

Please consider the environment before printing this e-mail

From: Greczmiel, Horst
Sent: Monday, February 24, 2014 1:50 PM
To: [REDACTED]

[REDACTED]

CEQ
Consultation/
Referral

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Horst Greczmiel
Associate Director for NEPA Oversight
Council on Environmental Quality

[REDACTED]

P

Please consider the environment before printing this e-mail

From: [Nan S. Walden](#)
To: [Blumenfeld, Jared](#); [Gaudario, Abigail](#)
Cc: [Meranda Scott](#); [Kathryn M. Liptak](#); [REDACTED] [Dick Walden](#)
Subject: FW: Request for Meeting with Nan and Dick Walden week of April 7, 2014 re Rosemont Mine
Date: Monday, April 07, 2014 8:58:07 AM

Abigail:

Have not heard back from you as to our request sent to you April 2 for meeting this week in San Francisco with Jared Blumenfeld. Dick and I arrive in SF Tuesday April 8 and are available Wed-Friday at the Administrator's convenience.

Pls reply to all, thank you.

Nan S. Walden

Cell (b) (6) [REDACTED]

Nan Stockholm Walden, J.D.
Vice President and Counsel
Farmers Investment Co. (FICO)

[REDACTED]
(b) (6)

Executive Assistant:
Meranda Scott

[REDACTED]
(b) (6)

From: Nan S. Walden
Sent: Wednesday, April 02, 2014 12:15 PM
To: blumenfeld.jared@epa.gov; 'gaudario.abigail@epa.gov'
Cc: 'Dick Walden'
Subject: Request for Meeting with Nan and Dick Walden week of April 7, 2014 re Rosemont Mine
Importance: High

Dear Jared:

Dick and I are in San Francisco the week of April 7 for Dick's Federal Reserve Board Advisory Committee meeting. I spoke with Abigail today—she thought we might be able to schedule a meeting with you on days other than April 9th or 11th. I am available **Tuesday the 8th** or **Thursday the 10th**, or I could come in earlier if **Monday April 7th** is better for you. Dick will join us according to his schedule with the Fed.

We would like to update you on the Save the Scenic Santa Ritas Coalition

latest comments through the USFS administrative appeals process, and on our meetings in DC this week.

Abigail can email me or text me on my cell phone at (b) (6).
Thank you very much.

Best,
Nan

Nan Stockholm Walden, J.D.
Vice President and Counsel
Farmers Investment Co. (FICO)

(b) (6)

Executive Assistant:
Meranda Scott

(b) (6)

From: [David Steele](#)
To: [Blumenfeld, Jared](#)
Cc: [Nan Stockholm Walden](#)
Subject: Fwd: Timely Q
Date: Thursday, March 27, 2014 4:40:43 PM

Administrator Blumenfeld:

I work for Nan Walden and met you when you were in Tucson recently. Nan is having email problems and asked that I forward this email from her to you.

Thank you.

David S. Steele

From: Nan S. Walden
Sent: Thursday, March 27, 2014 2:28 PM
To: Jared Blumenfeld
Subject: Timely Q
Importance: High

Dear Administrator Blumenfeld:

Called your office today but understand you are on travel. Would very much appreciate it you are able to call me back on time sensitive q/issue related to Rosemont Mine. I am in DC, my cell is

(b) (6)

Thank you.

Nan

Nan Stockholm Walden, J.D.
Vice President and Counsel
Farmers Investment Co. (FICO)

(b) (6)

Executive Assistant:
Meranda Scott

(b) (6)

David Steele

(b) (6)

From: [Nan S. Walden](#)
To: [sun, nelly](#); [Meranda Scott](#); [kathryn.m.liptak](#) (b) (6)
Cc: [Gaudario, Abigail](#); [Dick Walden](#)
Subject: RE: Request for Meeting with Nan and Dick Walden week of April 7, 2014 re Rosemont Mine
Date: Monday, April 07, 2014 10:58:05 AM

Thanks so much, Nelly. Thurs at 2:45 pm is just perfect.
For our part, it will be myself and my husband Dick Walden.
Thank you again.
Nan
Cell: (b) (6)

Nan Stockholm Walden, J.D.
Vice President and Counsel
Farmers Investment Co. (FICO)

(b) (6)

Executive Assistant:
Meranda Scott

(b) (6)

From: sun, nelly [mailto:sun.nelly@epa.gov]
Sent: Monday, April 07, 2014 10:49 AM
To: Nan S. Walden; Meranda Scott; [kathryn.m.liptak](#) (b) (6)
Cc: Gaudario, Abigail
Subject: RE: Request for Meeting with Nan and Dick Walden week of April 7, 2014 re Rosemont Mine

Dear Nan & Meranda:

Jared Blumenfeld forwarded your email to me; my colleague Abigail is out today. Can you meet with Jared this Thursday, April 10th @ 2:45 pm?

Thanks,

Nelly

From: Nan S. Walden <[REDACTED]>
Sent: Monday, April 07, 2014 8:54:55 AM
To: Blumenfeld, Jared; Gaudario, Abigail
Cc: Meranda Scott; Kathryn M. Liptak (b) (6); Dick Walden
Subject: FW: Request for Meeting with Nan and Dick Walden week of April 7, 2014 re Rosemont Mine

Abigail:

Have not heard back from you as to our request sent to you April 2 for meeting this week in San Francisco with Jared Blumenfeld. Dick and I arrive in SF Tuesday April 8 and are available Wed-Friday at the Administrator's convenience.

Pls reply to all, thank you.

Nan S. Walden

Cell (b) (6)

Nan Stockholm Walden, J.D.
Vice President and Counsel
Farmers Investment Co. (FICO)

(b) (6)

Executive Assistant:

Meranda Scott

mscott@greenvalleypecan.com

(b) (6)

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Sent: Wednesday, April 02, 2014 12:15 PM

To: blumenfeld.jared@epa.gov; 'gaudario.abigail@epa.gov'

Cc: 'Dick Walden'

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Best,
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Nan Stockholm Walden, J.D.
Vice President and Counsel
Farmers Investment Co. (FICO)

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

(b) (6)

Executive Assistant:
Meranda Scott

[REDACTED]
[REDACTED]

(b) (6)

From: [sun, nelly](#)
To: [nswalder](#) [REDACTED] [mscott](#) [REDACTED] [kathryn.m.liptak](#) (b) (6)
Cc: [Gaudario, Abigail](#)
Subject: RE: Request for Meeting with Nan and Dick Walden week of April 7, 2014 re Rosemont Mine
Date: Monday, April 07, 2014 10:49:05 AM

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Thanks,

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Sent: Monday, April 07, 2014 8:54:55 AM
To: Blumenfeld, Jared; Gaudario, Abigail
Cc: Meranda Scott; Kathryn M. Liptak ([kathryn.m.liptak](#) (b) (6) [REDACTED]); Dick Walden
Subject: FW: Request for Meeting with Nan and Dick Walden week of April 7, 2014 re Rosemont Mine

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Nan S. Walden

Cell (b) (6) [REDACTED]

Nan Stockholm Walden, J.D.
Vice President and Counsel
Farmers Investment Co. (FICO)

[REDACTED]
[REDACTED]
[REDACTED]
(b) (6)

Executive Assistant:
Meranda Scott

[REDACTED]
(b) (6)

From: Nan S. Walden
Sent: Wednesday, April 02, 2014 12:15 PM
To: blumenfeld.jared@epa.gov; 'gaudario.abigail@epa.gov'
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Importance: High

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Nan

Nan Stockholm Walden, J.D.
Vice President and Counsel
Farmers Investment Co. (FICO)

(b) (6)

Executive Assistant:
Meranda Scott

(b) (6)

From: [sun, nelly](#)
To: [Nan S. Walden](#); [Meranda Scott](#); [kathryn.m.liptak](#) (b) (6)
Cc: [Gaudario, Abigail](#); [Dick Walden](#); [Kwok, Frances](#)
Subject: RE: Request for Meeting with Nan and Dick Walden week of April 7, 2014 re Rosemont Mine
Date: Monday, April 07, 2014 11:15:40 AM

Excellent! I will submit your names to our Security Desk. Please bring I.D. with you to show to the guards, and then you go through security check. Once you have passed security and have been issued visitors badges, please call me at 415-947-8702 and I will escort you to Jared's office.

From: Nan S. Walden [mailto:[B6](#)]
Sent: Monday, April 07, 2014 10:55 AM
To: sun, nelly; Meranda Scott; [kathryn.m.liptak](#) (b) (6)
Cc: Gaudario, Abigail; Dick Walden
Subject: RE: Request for Meeting with Nan and Dick Walden week of April 7, 2014 re Rosemont Mine
Importance: High

Thanks so much, Nelly. Thurs at 2:45 pm is just perfect.
For our part, it will be myself and my husband Dick Walden.
Thank you again.

Nan

Cell: (b) (6)

Nan Stockholm Walden, J.D.
Vice President and Counsel
Farmers Investment Co. (FICO)

(b) (6)

Executive Assistant:
Meranda Scott

(b) (6)

From: sun, nelly [<mailto:sun.nelly@epa.gov>]
Sent: Monday, April 07, 2014 10:49 AM
To: Nan S. Walden; Meranda Scott; [kathryn.m.liptak](#) (b) (6)
Cc: Gaudario, Abigail
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Thanks,

Nelly

From: Nan S. Walden <[n](#) [REDACTED] B6 >
Sent: Monday, April 07, 2014 8:54:55 AM
To: Blumenfeld, Jared; Gaudario, Abigail
Cc: Meranda Scott; Kathryn M. Liptak ([k](#) [REDACTED] B6); Dick Walden
Subject: FW: Request for Meeting with Nan and Dick Walden week of April 7, 2014 re Rosemont Mine

Abigail:

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Pls reply to all, thank you.

Nan S. Walden

Cell (b) (6) [REDACTED]

Nan Stockholm Walden, J.D.
Vice President and Counsel
Farmers Investment Co. (FICO)

[REDACTED]
(b) (6) [REDACTED]

Executive Assistant:
Meranda Scott

[REDACTED]
(b) (6) [REDACTED]

From: Nan S. Walden
Sent: Wednesday, April 02, 2014 12:15 PM
To: blumenfeld.jared@epa.gov; 'gaudario.abigail@epa.gov'
Cc: 'Dick Walden'
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Importance: High

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Thank you very much.

Best,
Nan

Nan Stockholm Walden, J.D.
Vice President and Counsel
Farmers Investment Co. (FICO)

(b) (6)

Executive Assistant:
Meranda Scott

(b) (6)

From: [Ryerson.Teddy](#)
To: [Horst.Greczmiel](#); [Dunning.Connell](#)
Cc: [Hanf.Lisa](#); [Brush.Jason](#); [Martynowicz.Trina](#)
Subject: Re: Reminder, Please RSVP RE: Invitation to Rosemont Mine Meeting Feb 28, 3pm: RSVP requested cob Feb 25
Date: Thursday, February 27, 2014 7:30:06 AM

Hey Horst - we'll check with Jared and get back to you. Thanks!

Nancy J. ("Teddy") Ryerson
Chief of Staff to the Regional Administrator
U.S. EPA, Pacific Southwest Office
Office: 415-947-8702
Cell: [REDACTED] B6

From: Greczmiel, Horst <[REDACTED] B6 v>
Sent: Thursday, February 27, 2014 6:05:19 AM
To: Dunning, Connell
Cc: Hanf, Lisa; Brush, Jason; Martynowicz, Trina; Ryerson.Teddy

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Horst Greczmiel
Associate Director for NEPA Oversight
Council on Environmental Quality
(b) (6)

Please consider the environment before printing this e-mail

-----Original Message-----

From: Dunning, Connell [<mailto:Dunning.Connell@epa.gov>]
Sent: Wednesday, February 26, 2014 1:46 PM
To: Greczmiel, Horst
Cc: Hanf, Lisa; Brush, Jason; Martynowicz, Trina; Ryerson.Teddy
Subject: FW: Reminder, Please RSVP RE: Invitation to Rosemont Mine Meeting Feb 28, 3pm: RSVP requested cob Feb 25
Importance: High

Horst,

Please add my name and Lisa Hanf's name to all correspondence that you send regarding Rosemont. It is critical that we each receive emails since Kathy Goforth is out for the next month. Jared relies on Lisa and me to highlight important meetings for the NEPA process and I can't do so without getting the emails.

Also, your previous cancellation of the Regular Friday call for Feb. 28th, along with a planned invite for a call at the same time has confused several folks here.

I am confirming that it is your intention to attempt to hold the Senior Staff/High Level call this Friday at 3:00 pm EST? I will reiterate to Jared the need for him to RSVP for this Senior Staff/High Level call since he may be assuming the Friday call is cancelled due to the previous email.

Thanks,
Connell

Connell Dunning
Environmental Review Office
US EPA Region IX, Pacific Southwest
75 Hawthorne St (ENF-4-2), SF, CA 94105
dunning.connell@epa.gov
phone - 415-947-4161 fax- 415-947-8026

-----Original Message-----

From: Brush, Jason
Sent: Wednesday, February 26, 2014 7:57 AM
To: Dunning, Connell
Subject: Fw: Reminder, Please RSVP RE: Invitation to Rosemont Mine Meeting Feb 28, 3pm: RSVP requested cob Feb 25
Importance: High

* sigh * #confused

From: Greczmiel, Horst <[REDACTED]>
Sent: Wednesday, February 26, 2014 6:21:23 AM
To: [REDACTED]

CEQ CONSULTATION/REFERRAL

Horst Greczmiel
Associate Director for NEPA Oversight
Council on Environmental Quality
2(b) (6) [REDACTED]

P

Please consider the environment before printing this e-mail

From: Greczmiel, Horst
Sent: Monday, February 24, 2014 1:50 PM
To: [REDACTED]

CEQ CONSULTATION/REFERRAL

[REDACTED]

Good afternoon,

[REDACTED]
CEQ CONSULTATION/REFERRAL
[REDACTED]

[REDACTED]

[REDACTED]

Thank you,

Horst Greczmiel
Associate Director for NEPA Oversight
Council on Environmental Quality

[REDACTED]

P

Please consider the environment before printing this e-mail

From: [Nan S. Walden](#)
To: [Blumenfeld, Jared](#); [Gaudario, Abigail](#)
Cc: [Dick Walden](#)
Subject: Request for Meeting with Nan and Dick Walden week of April 7, 2014 re Rosemont Mine
Date: Wednesday, April 02, 2014 12:43:32 PM

Dear Jared:

Dick and I are in San Francisco the week of April 7 for Dick's Federal Reserve Board Advisory Committee meeting. I spoke with Abigail today—she thought we might be able to schedule a meeting with you on days other than April 9th or 11th. I am available **Tuesday the 8th** or **Thursday the 10th**, or I could come in earlier if **Monday April 7th** is better for you. Dick will join us according to his schedule with the Fed.

We would like to update you on the Save the Scenic Santa Ritas Coalition latest comments through the USFS administrative appeals process, and on our meetings in DC this week.

Abigail can email me or text me on my cell phone at (b) (6)
Thank you very much.

Best,
Nan

Nan Stockholm Walden, J.D.
Vice President and Counsel
Farmers Investment Co. (FICO)

(b) (6)

Executive Assistant:
Meranda Scott

(b) (6)

From: [Deborah Haro](#)
To: ["rosemont401comments@azdeq.gov"](#)
Cc: [kmcolloton.spl@usace.army.mil](#); [Blumenfeld, Jared](#)
Subject: Rosemont ADEQ 401 Certification Comments
Date: Friday, April 04, 2014 2:59:58 PM
Attachments: [removed.txt](#)
[rs-rosemont_adeq_401_certification_comments.pdf](#)

Good afternoon Mr. Scalamera,

Please see the attached correspondence from Mr. Huckelberry regarding the above subject. The original letter will be provided to you via US mail.

*Thank you,
Debbie*

*Deborah Haro
Pima County Administrator's Office
130 W. Congress Street, Floor 10
Tucson, Arizona 85701
Deborah.Haro@pima.gov
520.724.8770
Right Fax 770-4201*



COUNTY ADMINISTRATOR'S OFFICE

PIMA COUNTY GOVERNMENTAL CENTER
130 W. CONGRESS, FLOOR 10, TUCSON, AZ 85701-1317
(520) 724-8661 FAX (520) 724-8171

C.H. HUCKELBERRY
County Administrator

April 4, 2014

Robert Scalamera, Project Manager
Surface Water Section, MC5415A-1
Arizona Department of Environmental Quality
1110 West Washington Street
Phoenix, Arizona 85007

Re: Arizona Department of Environmental Quality 401 Certification for Rosemont Copper, Public Notice 27-14AZ LTF 55425

Dear Mr. Scalamera:

This letter presents additional consolidated comments by the Pima County Regional Flood Control District and Pima County on the Draft 401 certification for the Clean Water Act Section 404 permit for the Rosemont Copper Project. After I sent our comments to you, the Arizona Department of Environmental Quality (ADEQ) extended the comment period until April 7, 2014. ADEQ has also provided a copy of the agency's basis for the proposed certification that was not available during our previous review. Thank you for making this document available.

The additional comments provided herein largely pertain to that document, formally titled "Basis for State 401 Certification Decision, Rosemont Copper Project, ACOE Application No. SPL-2008-00816-MB". This document makes clear that ADEQ's draft certification has relied upon faulty information in the Final Environmental Impact Statement (EIS) and unsubstantiated opinions in documents that were provided by Rosemont Copper. Pima County and many others object to many of the conclusions of the Final EIS. Our previous review also found that ADEQ relied upon data and designs that no longer represent the mine as proposed to the US Army Corps of Engineers and the US Forest Service.

Mr. Robert Scalamera

Re: **Arizona Department of Environmental Quality 401 Certification for Rosemont Copper,
Public Notice 27-14AZ LTF 55425**

April 4, 2014

Page 2

On behalf of Pima County and the Regional Flood Control District, I urge ADEQ to deny the 401 certification for the Rosemont Copper project.

Sincerely,

A handwritten signature in black ink, appearing to read "C.H. Huckelberry", with a long, sweeping underline that extends to the right.

C.H. Huckelberry
County Administrator

CHH/mjk

Attachment

- c. Colonel Kimberly Colloton, Los Angeles District Engineer, US Army Corps of Engineers
Jared Blumenfeld, Region IX Administrator, US Environmental Protection Agency

Additional Comments on State 401 Certification Decision – Rosemont Copper Project ACOE Application No. SPL – 2008-00816-MB

Prepared by

Evan Canfield and Akitsu Kimoto, Pima County Regional Flood Control District, and
Brian Powell and Julia Fonseca, Pima County Office of Sustainability and Conservation

On Behalf of

C. H. Huckelberry, County Administrator
130 W. Congress, Tucson, AZ 85701

Background

ADEQ has provided us their basis for 401 certification. Many of our additional comments to ADEQ restate previous concerns raised in the FEIS, because many of the findings in the Basis for State 401 Certification were supported with conclusions from the FEIS that we believe are in error. This document also presents new data and new concerns with ADEQ's basis for the certification.

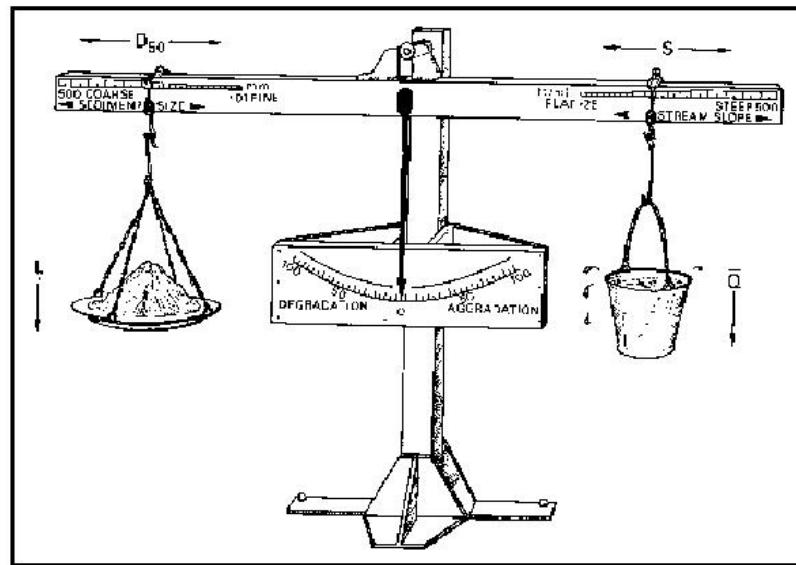
Stormwater and Sediment Transport Review

We have previously described concerns with the stormwater analysis and sediment transport analysis used in the FEIS (Attachment 1), and therefore believe that the Basis for State 401 Certification is based on erroneous analysis.

Summary:

- 1.) ***Factor: Changes in loadings and the nature, persistence and potential effects of the parameter: Sediment Delivery/Sediment Yield (p.8).***
 - a.) Previously-raised concerns: As we noted in our concerns about the FEIS there will be a reduction in sediment yield from Barrel Canyon watershed but no change in the geomorphology of the channel is expected. The FEIS only discusses annual average sediment delivery. The FEIS did not consider cumulative impacts of sediment delivery change over the active mine period and post-closure. Considering the proposed active mine life is over 20 years, the FEIS should assess long term impacts on sediment yield, delivery and channel geomorphology. County PAFEIS comments, p. 79.
 - b.) Concerns about the Patterson and Annandale 2012 assessment: The Basis for State 401 Certification cited an independent Forest Service Review (Patterson and Annandale, 2012; see Attachment 2). We have a number of concerns about this evaluation as follows:
 - a. *The level of effort is not adequate to establish that removal of the sediment supply will have no downstream effects.* While this is described as a 'study,' it is in fact a summary of observations from a two-day field visit labeled a 'Technical Memorandum' which includes five page of text and no measured field data.

- b. *It is not sealed by a Professional Engineer or Professional Geologist registered in the State of Arizona:* This is particularly concerning because the evaluation, because it includes no data, is essentially a statement of professional judgment.
- c. *It does not consider explicitly break out current and proposed conditions in the context of sedimentation processes:* Two widely-accepted frameworks are:
- i. *The Concept that there is a relationship between sediment supply, the capability of a channel to transport that sediment (Lane's balance: Lane, 1954):*



$$Q_s \cdot D_{50} \propto Q_w \cdot S$$

Where

Q_s = Sediment Discharge

D_{50} = Sediment Particle Size

Q_w = Streamflow

S = Stream Slope

- ii. *The Concept of Sediment Transport Capacity:* Flowing water expends energy transporting sediment because sediment particles are about three times heavier than water. Therefore flowing water has more energy if it has less sediment.

d. *Existing conditions:*

- i. *Sediment transport rates are high.* We agree with the observation by Patterson and Annandale (2012) that ... '*Streams such as these have extremely high sediment transport rates (for example, Reid, et al., 1998 and Greenbaum and Bergman 2006).*'
- ii. *Sediment is transported in suspension as well as bed load.* The evaluation done by Patterson and Annandale was unable to assess the importance of the suspended load in this environment because they did not evaluate conditions when water is flowing. Sediment may travel in suspension at steeper slopes (such as near the mine site) and as bed-load at shallower slopes (such as in Davidson Canyon).
- iii. *Sediment supply rates are high and expected to be higher at the mine site:* Erosion equations such as the Revised Universal Soil Loss Equation (RUSLE; Renard et al, 1991) recognize that slope steepness and higher rainfall depths and intensities erode soils. Watersheds are steep with limited cover, and erosion rates are high even though rainfall may be low (e.g. Langbein and Schumm, 1958). Patterson and Annandale continue to build on the idea that impact of the mine is proportional to the catchment area and cite previous Rosemont Reports (they note that the mine is only 13% of watershed) without looking at the sediment supply potential differences across the watershed. The deep valley fill in the Tucson basin is generated by erosion of sediment off the mountains and depositing in the valley.
- iv. *Natural and man-made grade controls exist on Barrel Creek:* Patterson and Annandale have identified some places where grade controls maintain channel grade under current conditions.

e. *Proposed Conditions:*

- i. *Sediment Supply from the mine site will be nearly eliminated.* With the proposed compliance point dams, the sediment downstream of the compliance point dams will be cut off. In the context of Lane's balance, Q_s will go to nearly '0'.
- f. *Effect of grade controls when sediment supply is cut off:* There are numerous examples of scour downstream of grade controls that capture sediment. A classic example is the Pantano dam on Cienega Creek, which has 10 feet of scour downstream of the dam. In the context of Lane's balance, when supply is cut off (Q_s goes down), scour occurs downstream of the grade control structure. In essence this is because a natural watercourse will attempt to come into equilibrium by increasing Q_s on the downstream of the dam.

While Patterson and Annandale contend that grade controls will maintain channel slope under proposed conditions where sediment supply is cut off by the mine site, it defies our observations in this area. Furthermore, we contend that the impact will be great because the current sediment supply and transport rates at the proposed mine site are extremely high.

2.) **Factor: Reduction in available assimilative capacity: Reduction in runoff volume (p.9).**

- a. To reiterate our concerns about the reliance on the FEIS in assessing impacts, the FEIS shows that the Barrel Alternative results in a predicted 17.2% reduction in average annual post closure runoff volume from the watershed. ADEQ failed to assess larger impacts on runoff loss during pre-mining and active mining periods, especially during the first 10 years of active mining. The FEIS (p.424) clearly stated that the impacts during these periods are high (FEIS, p. 424 The maximum loss of runoff to the watershed occurs during the first 10 years of active mining when runoff from these areas is retained onsite and recycled as process water. During this period, the loss of runoff would vary but is likely to approach a reduction in annual average runoff of about 30 to 40 percent, compared with undeveloped baseline conditions (SWCA Environmental Consultants 2013f)). As ADEQ cited, the 17.2% reduction could result in a potential loss of assimilative capacity and potential degradation of water quality. It is not clear why there was no discussion about the larger impacts during pre- and active mining periods.

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Impacts of Reduced flows and Increased Total Dissolved Solids (TDS) on the Riparian Vegetation of Cienega Creek

The cottonwood/willow forest and wetlands of the Cienega Creek Natural Preserve is keystone feature of the natural environment of eastern Pima County. Unfortunately, gallery forest and wetlands are highly stressed by the current drought conditions (Powell 2013). The shallow groundwater system that these trees rely on will be further stressed by the proposed Rosemont mine, which will reduce the flows to the creek. The quality of the water being lost to the creek is also important to consider. The water in Davidson Canyon is significantly lower in total dissolved solids (TDS) as compared to the water in Cienega Creek. Lower dissolved solids are a key reason for the designation of Davidson Canyon as an Outstanding Waters (Pima Association of Governments 2005). The reduction in the amount of this higher-quality water, along with the added dissolved solids from the mining operation, could have a profound effect on the cottonwood/willow forest of Cienega Creek. This has not been analyzed or acknowledged in the 401 application. This needs to be done in light of the fact that elsewhere in southern and western Arizona, the conversion of gallery cottonwood/willow forests to tamarix-dominated sites is correlated with higher concentrations of dissolved solids and impoundment of and regulation of streams (Vandersande et. al. 2001; Shafroth et. al. 2002; Pataki et. al. 2005; Stromberg et. al. 2007). The withholding of water in the upper reaches of Barrel would constitute stream regulation.

Lack of Analysis on Precipitation Timing, Recharge Rates, and Climate Change

The Rosemont Mine project will impact the amount of water flowing out of Barrel Canyon and into Davidson Canyon and Cienega Creek. Because ADEQ is required to ensure that there is no degradation to the Outstanding Arizona Waters of these sites, it is incumbent on the applicant to address impacts to water quantity. In our comments on the Forest Service's FEIS, Pima County took issue with the amount of water that is predicted to be impacted (i.e., held back) by the mine. For the purposes of the 401 application, it is imperative that the analysis look not just at the amount of water being withheld, but the timing of that impact. This is important because of southern Arizona's bi-modal precipitation pattern and the scientifically established fact that groundwater recharge is influenced by the seasonality of rainfall (Ajami et. al. 2012). The picture is further complicated by climate predictions, which estimate that groundwater recharge rates could be reduced by as much as 27% by the end of this century (Serrat-Capdevila et. al. 2007). There is no analysis of these factors, yet in order to ensure that no degradation of AOW will result from the mine, this analysis is critical. This analysis would at least identify the amount of water that Rosemont Mine needs to contribute to the system to make up for losses resulting from the proposed impoundment and use of water.

Increased Temperature and Lower Dissolved Oxygen

The analysis of the impacts of the Rosemont Mine do not consider two key variables in the water quality: increased water temperature and dissolved oxygen. As has been clearly established, the retention of stormwater that contributes baseflows in Davidson and Cienega Creek will reduce Cienega Creek baseflows. Rosemont has not modeled how this will impact water temperature and dissolved oxygen in Cienega Creek. Pima County believes that surface water temperatures in Cienega Creek will increase as a result of lower flows and less shading canopy as a result of a decline in the number and/or vigor of large cottonwood trees. (The decline in cottonwood trees would reduce evapotranspiration rates and thus result in a reduction in the loss of water from Cienega Creek, but this has not been investigated either.) This is a concern from the perspective of the aquatic species in Cienega Creek and the importance of the high-quality water coming from Davidson Canyon. The amount and quality of Davidson Canyon water on aquatic plants and animals of Cienega Creek was an important factor in

Davidson being designated as an AOW. With the prospect of increased water temperatures, this can lead to lowered dissolved oxygen, which can impact fish populations, especially with loss of canopy structure (Connor et. al. 2003). These issues, including how they will change under climate change scenarios must be addressed before the permit can be issued.

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Review of Isotope Data

ADEQ has decided that *“Lower Davidson Canyon is not hydraulically connected to the regional aquifer that would be impacted by the pit dewatering.”* ADEQ’s reasoning is flawed.

1. ADEQ has not conducted an independent review of the primary data. ADEQ should request the primary data and conduct its own review. ADEQ should not rely on opinions of others. ADEQ cites the FEIS for its information. The FEIS and ADEQ cite Tetra Tech (2010) for its interpretations. Tetra Tech (2010) in turn presents and interprets isotope and water quality data collected by PAG (2003) and Montgomery and Associates (2009). There is no evidence that ADEQ reviewed the Montgomery and Associates (2009) report, which contains the bulk of the primary data on water quality in the mine vicinity.
2. The FEIS also cites SRK’s review of Tetra Tech’s interpretation, but SRK did not review the primary data either. The FEIS preparers only reviewed Tetra Tech (2010) interpretation of data collected by others. SRK (2012) relied on Tetra Tech’s faulty interpretation that *“wells and springs in the upper reaches in Davidson Canyon have isotopic values indicating winter recharge from precipitation is a significant source of water (Tetra Tech 2010a). Water samples taken for Reach 2 Spring in Lower Davidson Canyon has a geochemical signature that indicates the spring water is primarily influence by summer rain: this suggest that bedrock groundwater is not a significant component of the Reach 2 Spring.”*
3. Tetra Tech’s interpretation, and hence ADEQ’s review, is not supported by the actual isotopic work performed by Montgomery and Associates. ADEQ cites Tetra Tech’s opinion as: *“Isotopic signatures of water from these two springs reflect the influence of summer precipitation, in contrast to wells in the regional aquifer which reflect the influence of winter precipitation”*. Our review of primary data supports a very different conclusion about wells in the regional aquifer. Please see Table 12, result of Laboratory Analyses for Delta Oxygen-18, Deuterium, and Tritium in Groundwater and Surface Water Samples, Rosemont Area, Pima County, Arizona (Montgomery and Associates, 2009). Oxygen isotopes in wells near the mine site are heterogeneous, varying from -6.9 at RP-8 to -12.4 at RP-4B. Thus it would be incorrect to say that *wells in the regional aquifer reflect the influence of winter precipitation*. In fact, groundwater shows a wide range of $\delta^{18}\text{O}$ values. This review will demonstrate that the values reflect the influence of both winter and summer precipitation.

This is also shown graphically on Figure 8, Graph of Deuterium Versus Delta Oxygen-18 from Wells, Springs, and Surface Water Locations, April through October 2008, Rosemont Area (Montgomery and Associates, 2009). This figure is reproduced below. Wells are crosses. Note that the well delta oxygen values range from -12 to -7 on the horizontal scale. Note also that range of values for springs (diamonds) occupies nearly the same range, excepting the singular well value at RP-4B, which is a deep well screened in the Apache Canyon Formation.

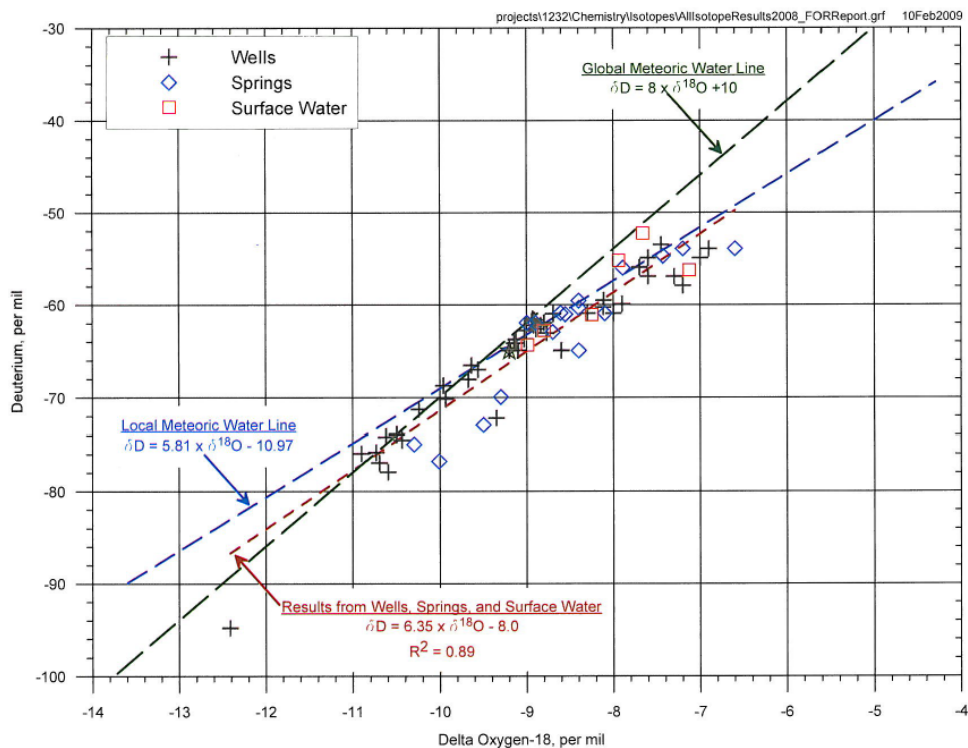
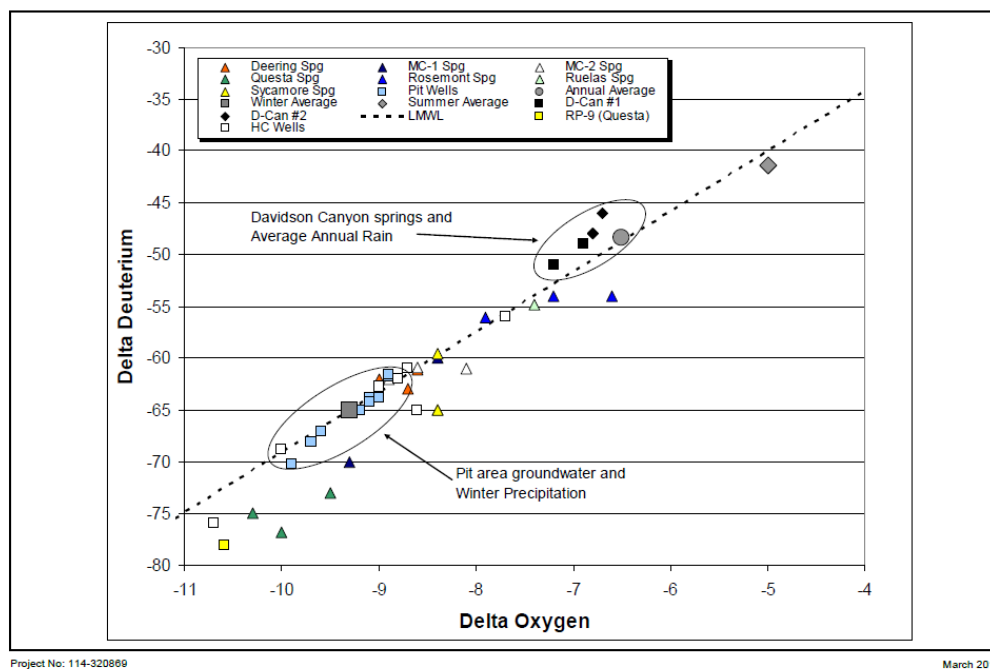


FIGURE 8. GRAPH OF DEUTERIUM VERSUS DELTA OXYGEN-18 FROM WELLS, SPRINGS, AND SURFACE WATER LOCATIONS, APRIL THROUGH OCTOBER 2008, ROSEMONT AREA



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Montgomery Figure 8



Tetra Tech Figure 17

Figure 17
Stable isotopes in Rosemont project site ground- and surface water

Some of these same data are shown on Figure 17 from Tetra Tech (2010), which differentiates the pit area groundwater (primarily PC well series) from other wells and springs in the mine vicinity. While it is true that the pit well data are largely grouped in the lighter oxygen values, many of Montgomery's other well and surface water data plot right along the red line calculated by Montgomery using the entire data set, suggesting that they are from the same population.

4. Referencing Montgomery's Figure 8 again, note that all of the samples, even the PC wells, plotted below the Global Meteoric Water Line. This is not disclosed by Tetra Tech, and in fact the Tetra Tech plot actually obscures this fact by plotting a dashed line that does not represent the Global Meteoric Water Line. It can be seen that the intercept of Tetra Tech's line is much lower than the Global Meteoric Water Line that Montgomery shows. The slope of the local data, and the values of the PC wells considered as a group *both show substantial influence from natural evaporation during precipitation, runoff and / or recharge*, as was noted by Montgomery and Associates in their 2009 report. Tetra Tech did not discuss Montgomery's observation of an evaporative effect, presumably because it did not fit their preferred interpretation.
5. Tetra Tech's Figure 17 includes a data point representing winter average rainfall. This value is important because it is the principal basis for the inference that the position of the "*pit area groundwater*" on figure 17 means that *winter precipitation* is the source of the groundwater for the PC wells. Tetra Tech says that the winter average value is based on "stable isotope data for local precipitation" by Wagner (2006). Page 124 of Wagner 2006 provided several years of precipitation data from the vicinity of Cave of the Bells, in the Santa Rita mountains farther south. There were too few years in Wagner's sample to define a local meteoric water line (Dr. Chris Eastoe, personal communication).
6. Figure 8 (Montgomery and Associates 2009) also has a local meteoric water line (LMWL) derived from data provided by Dr. Chris Eastoe. In attachment 3, Dr. Eastoe presents a more robust dataset for a LMWL. LMWL's are important because they provide a basis for interpreting sample results.
7. The effects of evaporation on isotopes in rainfall at Palisades Ranger Station (Santa Catalina Mountains) is much less developed than in the lower elevation Tucson data (Attachment 3, Figures 1A and 1B). According to Dr. Eastoe, the Rosemont pit site is at about 1500 masl, and precipitation at the site most likely has stable isotope distributions (ranges, and trends on the delta D vs. delta 18O plot) between those of the Tucson and Palisades stations.
8. Dr. Eastoe plots an evaporation trend based on the Montgomery data on his Figure 1A (Attachment 3). Tetra Tech did not consider any evaporation trends in their interpretation.
9. Tetra Tech's claim that Rosemont groundwater in the PC wells represents winter recharge is not supported by the interpretation that Dr. Eastoe presents in Attachment 3. The observed values would require a mix of summer and winter rains to produce the observed values of delta -9‰ at Rosemont (the origin point of the evaporation trend plotted on Figure 1A of Attachment 3). Only values of delta -11‰, or lighter would correspond with winter precipitation (see Fig. 2, Attachment 3).

10. Tetra Tech omitted well data that did not support their hypothesis. Tetra Tech's Figure 17 omits many of the wells and spring samples that plotted closer to the PAG dataset, but retained the "pit wells" that favored Tetra Tech's interpretation. The omitted samples that plotted closer to the PAG data set included wells RP-4A and RP-3A located in areas under the waste rock and tailings landform, and Rosemont spring, which would also be covered with waste rock and tailings.
11. The major ion chemistry of wells in the Rosemont mine area as documented in Montgomery (2009) reflects multiple water sources. A map which shows major ion chemistry in the form of Stiff diagrams is reproduced without attribution to the authors as Figure 18 in Tetra Tech (2010). The map at Figure 18 shows that the vicinity of the open pit, the groundwater is calcium bicarbonate, consistent with TetraTech's interpretation (2010). There is another type of water, dominated by CaSO_4 and having much higher TDS than most other wells, associated with Pit Characterization wells PC-3, PC-7, PC-6, and wells RP-7, and P-899. Thus, on the basis of major ion chemistry, water chemistry even in the pit area is seen to vary considerably.

Note also that the east of the pit, the groundwater is mix of calcium bicarbonate, sodium bicarbonate, and calcium sulfate type waters (Montgomery and Associates 2009). There is also a zone of Na-rich bicarbonate waters that runs NE along the axis of Barrel Canyon from HC2B NE through HV-1 and the RP-2 series.

12. Turning now to the Davidson surface flows, Tetra Tech fails to plot or discuss the sample results shown on Montgomery's Table 12 for lower Davidson Canyon Wash. **This sample has a $\delta^{18}\text{O}$ value equal to -9.** This is similar to the pit wells and the so-called winter precipitation. Thus, Tetra Tech's interpretation regarding the character of Davidson spring **is not supported by the only sample which was contemporaneous with the well data to which it is compared.** No explanation is offered in the Tetra Tech report for this omission.
13. While ignoring contemporaneous Montgomery data that does not support their hypothesis, Tetra Tech included PAG 2003 data for Davidson. Below I have plotted the PAG data by hand on Montgomery's graph above for convenience. The line defined PAG's 2003 Davidson samples plots is within the trend line defined by Rosemont area groundwater. It does not plot below the trend line, with a flatter slope, which is what you would expect if the Davidson discharges were "local springs".

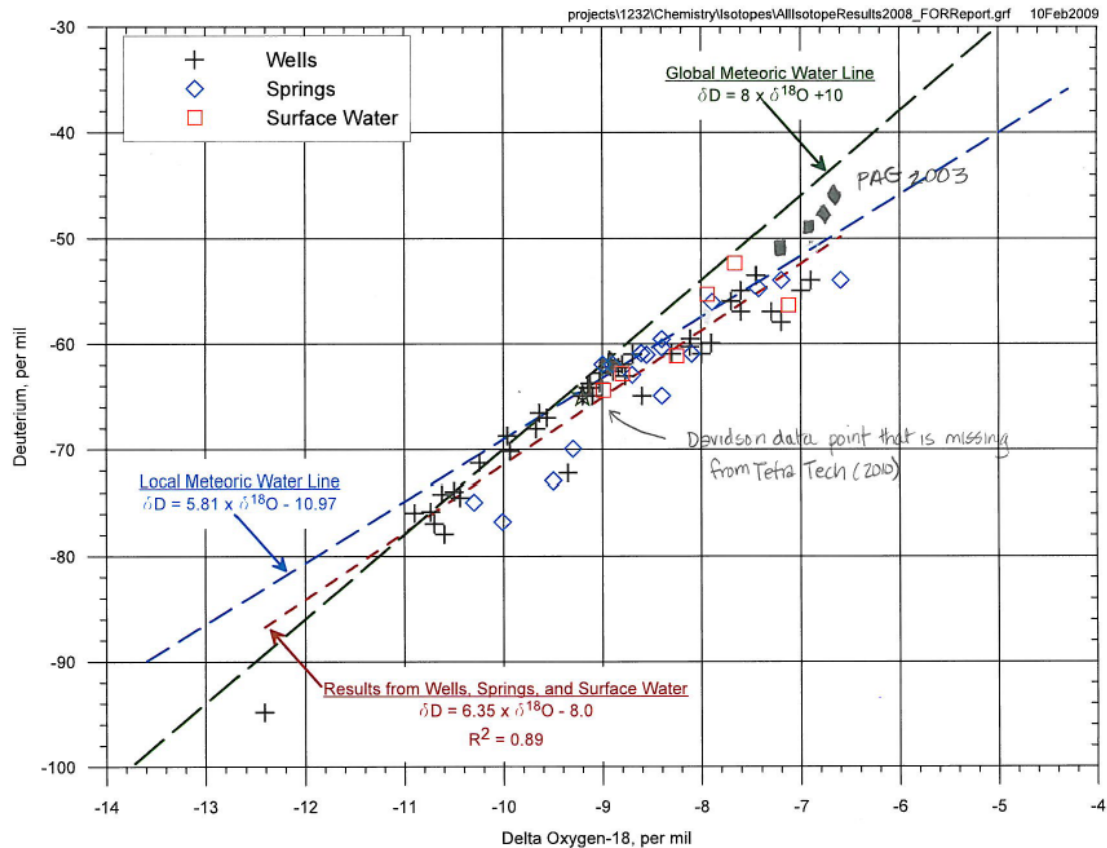


FIGURE 8. GRAPH OF DEUTERIUM VERSUS DELTA OXYGEN-18 FROM WELLS, SPRINGS, AND SURFACE WATER LOCATIONS, APRIL THROUGH OCTOBER 2008, ROSEMONT AREA

PAG 2003 DATA
 PLOTTED BY HAND



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14. Tetra Tech's interpretation ignored variability in dates for Davidson surface water samples they do include. The PAG isotope data were collected at a different time, June 2002 and May 2003 from Montgomery's Davidson Canyon sample. Tetra Tech makes no explanation regarding sources of variability between PAG and Montgomery data, because they omitted the Montgomery data.
15. Even PAG (2003) noted that *"the stable isotope data for Davidson Canyon base flows varied markedly between the Davidson #1 and Davidson #2 sample points. Davidson #1 is farther upstream and reflects a higher-elevation water source than Davidson #2."*
16. Montgomery collected their surface water sample in October 2008 at a location close to the confluence of Cienega Creek, near PAG's Davidson #2 site. This downstream site and collection date showed evidence for a mix of high elevation and low elevation runoff by virtue of its position within the trend line defined in red by the rest of the Rosemont data set. This can be seen by the position of the Davidson data point relative to other Rosemont area wells on the annotated graph above. The penciled arrow indicates the position of the 2008 Davidson sample, which plots in a very different location than the PAG values for Davidson samples, but solidly along the same trend.

17. During the term of PAG's study, Cienega Creek had consistently lighter delta O18 values than either of the two Davidson Canyon sites. During the term of Montgomery's study, Davidson had higher delta O18 values than either upper or lower Cienega Creek. Montgomery's data for Cienega Creek is not plotted, nor discussed by Tetra Tech. We can expect there to be year-to-year variation in values observed in spring flows, but Tetra Tech's interpretation obscures this phenomenon.
18. ADEQ's proposition that "*Lower Davidson Canyon is not hydraulically connected to the regional aquifer that would be impacted by the pit dewatering*" fails to address many of the direct and indirect effects of the dredge and fill activities related to the 404 permit. Pit dewatering is only one mine-related activity to be considered in making a determination regarding impacts upon Davidson Canyon water availability. Another significant impact is the alteration of transmission losses and thus recharge processes through the diversion, capture and impoundment of surface flows. ADEQ has not considered this in their basis for the anti-degradation finding. Another is the clearing and grubbing of soil above the bedrock—how will that affect transmission losses and recharge? How will recharge be affected by filling of entire valleys with waste rock and tailings? Given that these activities are directly related to the Section 404 permit, it is imperative that ADEQ consider the effects of these activities on infiltration losses. Another issue is how changes in the groundwater gradients induced by the pit lake (as opposed to *pit dewatering*) over time may alter the direction of underflow toward Davidson Canyon.
19. Pit dewatering strategies have changed since Tetra Tech (2010) and the FEIS failed to recognize this. New data show that pit dewatering can not be accomplished with wells. Rosemont will have to install costly drains in the Willow Canyon and basin fill in order to dig the pit. "*CNI recommends groundwater modeling to determine the anticipated horizontal drain spacing for dewatering approximately 100 to 200 feet behind the slope face. Because of the low conductivity values, a relatively tight spacing will be required resulting in a high cost to depressurize the [south] slope.....Because of the low hydraulic conductivities determined from pump tests mentioned previously, CNI did not consider a reduction in the phreatic surface level with the use of depressurization from vertical pumping wells.*" Nicholas, Standridge and Pratt, 20 July 2012, p.3.

In conclusion, ADEQ erred by not conducting an independent review of the primary data sets, instead relying on the interpretations of others. Tetra Tech cherry-picked data to support their conclusion, ignored complexity, and over-extended the information to the regional aquifer. The isotopic data support an interpretation that there are multiple sources of recharge in the mine vicinity, and these occur at different elevations. ADEQ cannot conclude on the basis of the isotope data that construction of the mine will not interfere with one or more of these recharge locations and mechanisms. ADEQ also failed to consider effects on recharge, other than pit dewatering. ADEQ basis also relied on Tetra Tech's evaluation of the old mine design to draw its conclusions. Finally, pit dewatering will occur by means that have not been evaluated by either Tetra Tech (2010) or ADEQ.

ADEQ should request the primary data sources and evaluate effects of discharge of dredging the waters of the US of their native soil and filling the Waters of the US. These dredge and fill activities will affect recharge processes that result from mountain front and stream-bed infiltration processes at a variety of locations. ADEQ should rely on the same dataset as the Corps; in order to do that, ADEQ must request

additional information from the applicant, because the applicant has provided incomplete and outdated information to ADEQ, as indicated in our previous letter of comment about this certification.

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Review of Assumptions regarding Regional vs Local Springs

On page 12, ADEQ's basis also relies on Tetra Tech's 2010 report that concludes that springs along Davidson Canyon are not likely connected to the regional aquifer because they have gone dry during the past few years, *"rather than being supported by perennial flow, as would be expected from a regional groundwater source (FEIS page 535)."*

It is not logical to assume that springs connected with the regional water table would not decline during times of drought or lack of recharge. Although perennial springs are likely to be fed by regional aquifer, it does not follow that a non-perennial spring is NOT related to the regional aquifer. In some areas, groundwater observations indicate that there have been declines in the regional aquifer, therefore cessation of flow at a nearby spring WOULD BE CONSISTENT with a connection to a regional aquifer.

With respect to Davidson Canyon, Tetra Tech presents PAG well observations at a well located near the OAW reach:

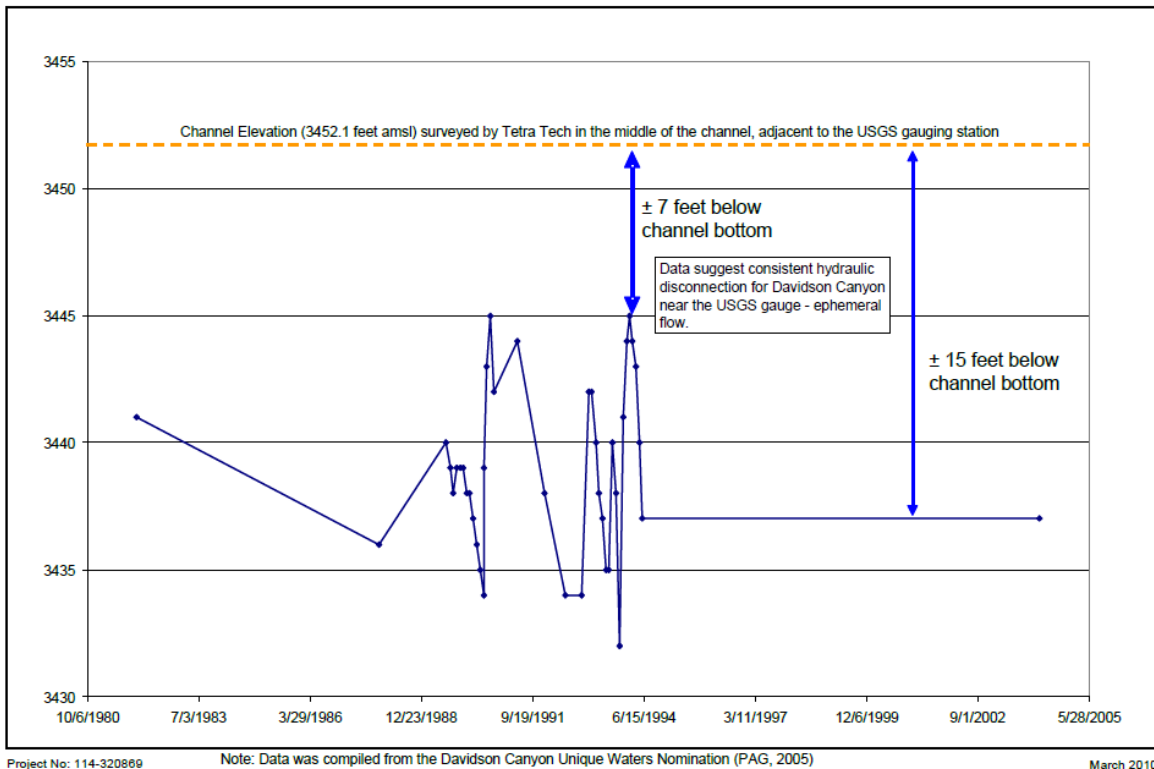


Figure 5
Pima County Well Hydrograph

Tetra Tech misrepresents the PAG (2005) data by plotting a line connecting individual observations separated by years. Tetra Tech further misrepresents the data by adding a text box on the graph interpreting the time between 1994 and 2005 as data suggesting a hydraulic disconnection, when it actually represents a data gap in the cited report (PAG 2005).

During the data gap shown on Figure 5 (1994-2005), Pima County obtained observations of flow and absence of flow from Sky Island Alliance. The observations were made at locations of animals tracks observed in the Davidson Canyon stream bed from the Interstate 10 bridge to 1.5 miles south. This reach includes Davidson adjacent to the County well mentioned above. During 2002-2005, there was either damp soil, running water, or standing water on 12 of 26 (46%) of the Sky Island sampling occasions. These observations were made during the 2002-2006 drought.

Damp	6
Dry	14
Running Water	3
Standing water	3

The well is located downstream and outside reach 2. Observations of groundwater levels at the well do not represent conditions at the reach 2 spring. The 2005 PAG report identifies several reaches of Davidson Canyon as having perennial and intermittent flow based on PAG observations, independent of the Sky Island Alliance data.

Seepage to Waters of the US and Seepage Monitoring

Page 5 and 6 of ADEQ's Basis refers to the potential for seepage from the waste rock and tailings piles to Waters of US. Pima County and Pima County Regional Flood Control District have objected to the inadequacy of the EIS with respect to seepage and seepage monitoring. The Forest Service is the process of reviewing objections. One objection is that the FEIS modeling of waste rock seepage is faulty. Another objection is that FEIS ignores the high probability of preferential seepage flow in the tailings and waste rock piles. A third objection is that the FEIS waste rock seepage monitoring plan will not result in adequate seepage impact evaluation .

Objection: The modeling of waste rock seepage is faulty.

The EIS must justify the parameters used and complete a sensitivity analysis of the parameters to demonstrate that the results of the seepage modeling are feasible; this is especially needed since there is no data to calibrate to. They must also justify ignoring preferential flow paths through the waste rock. The mine facility seepage analysis predicts there will be essentially no seepage through waste rock facilities, a result that is simply not feasible. The modeling used parameters in which the conductivity for relatively dry rock is six orders of magnitude less than when saturated. These parameters would allow a wetting front to move through unsaturated waste rock only very slowly; even most of a large event would be stored in the top few feet. After the storm ends, the close proximity of most of the seepage to the ground surface would allow the water to be evaporated away because evaporation would quickly establish an upward matric potential gradient.

The EIS repeats this error, which affects the quality of the organic constituent analyses. It does not seem reasonable that infiltration from waste rock be close to zero because natural recharge in this area is not zero. Blasted waste rock is almost certainly more conductive than the in-situ rock. It is also unlikely that the one foot thick cover will result in less infiltration than the natural soil and vegetation regime.

Similarly, it is not reasonable for the seepage through a leach pad to cease. Leach pads are designed to conduct flow. All water that gets through the cover will become seepage. Based on experience, the long-term seepage through heaps in more arid climates in Nevada do not approach rates as experience has shown that waste rock dumps in much drier climates will have seepage.

These three comments refer to the estimates of infiltration through waste rock, which have been estimated to be near zero. These comments had been made without reviewing the waste rock seepage study.

The modeling is effectively water balance modeling among layers in the facility, with [f]low between layers controlled by unsaturated flow equations, or saturated in areas where saturation occurs. Unsaturated flow modeling solves the equations of soil physics, most specifically the flow equation relating the matric potential gradient to the conductivity,

which varies as a function of matric potential. Unsaturated flow is toward the lower matric potential which occurs at the point where the media is drier, all other conditions being equal. When saturated the equation becomes Darcy's law and the matric potential gradient becomes the head gradient. Matric potential becomes negative as soil dries, so during dry conditions water from depth can be drawn to the surface and evaporated in a process known as exfiltration.

Tetra Tech utilized a two-dimensional variably saturated flow model, VADOSE/W, for this simulation (Tetra Tech 2010c, p. 20). The code solves the flow equations using a finite element routine. Two-dimensional means flow in a vertical cross section. Tetra Tech emphasizes that it "can simulate heterogeneous material, and can account for changes in material conditions due to compaction and underlying alluvial and/or bedrock formations" (Id.). This simply means that different model elements may be defined by different material property parameters and that those parameters can represent any material including compacted waste rock. The modeling presented in this Tetra Tech study is strictly based on conceptual flow models for the various materials because there are no data to which to calibrate. Material parameters depend on textbook or smallscale test values. The predicted values are not verified in any way to previously observed data.

The model simulates precipitation and evaporation, using various sequences of climate data for the simulations. Climate data provides the daily precipitation, temperature, wind speed, and evaporation. Using data from the Nogales site (Tetra Tech 2010c, p. 21) is not unreasonable, but the scenario using average daily values is not representative. TT states that the average conditions "dataset has small amounts of precipitation everyday because of the averaging of many years of data" (Id.) and call this "conservative". In a response to a review memorandum, TT (2011) responded that "[t]he average conditions dataset, as noted in previous memos, has precipitation nearly every day of the year. This is not likely to occur in Arizona, but would be a worst case scenario. Water is more likely to readily infiltrate into a facility if the upper surface is wet, so considering a climate conditions with a small amount of precipitation each day would produce such a condition and provide a result of the worst case infiltration" (TT, 2011, p. 2, emphasis added). Tetra Tech apparently considers this to be conservative, but the evaporation likely exceeds precipitation most days so there would rarely be an excess of precipitation to infiltrate. Even during winter, average precipitation may exceed the average evaporation by only a small amount, but the model would accumulate moisture in the top layers. This modeled soil moisture may just be stored and later evaporated as conditions warm and dry in the spring. Infiltration through the surface zone would occur when moist antecedent conditions precede a large daily rainfall; this type of situation which would result in seepage has been ignored in the Tetra Tech study. This is not uncommon during late winter or spring snow melt and subsequent spring showers.

The mine development periods and reclamation scenarios simulated are reasonable (TT, p. 22). Whether the parameters used for the scenarios were proper remains a question.

Tetra Tech discusses steady state modeling as a means of determining starting moisture concentrations for the transient simulations (Tetra Tech 2010c, p 37). In a system that should be event driven, steady state should never be approached, much less achieved.

The assumed parameters for the waste rock control the seepage through the waste rock facilities. The so-called permeability reported by Tetra Tech is actually saturated hydraulic conductivity (K). The values are very high, but the unsaturated values decrease very rapidly.

The figures showing the relationship of conductivity with matric suction and moisture with matric suction are poorly labeled. For example, Illustration 5.6 shows the relations for run-of-mine (ROM) rock, with saturated K equal to 174 ft/hr; the matric suction on the conductivity graph does not obviously match the axis for the moisture content, and does not have labels. Even the conductivity axis does not have labels for ROM rock.

Considering Ill 5.7 for semi-consolidated rock, the conductivity decreases over five orders of magnitude from saturated to dry (moisture 0.4 to 0.05). At the beginning of a storm with dry antecedent conditions, infiltrating precipitation increases the moisture content which increases the effective conductivity. As noted, the parameters for the surface ROM layer are hard to read, but dry (moisture about 0.16), the conductivity is significantly less than 174 ft/hr. Assuming no runoff, the ROM would rapidly saturate at a wetting front. Because of the low conductivity the wetting front would advance very slowly with conditions above the front being saturated. This means that significant amounts of ROM above a wetting front would be saturated. According to Ill 5.6, the difference between saturated and dry moisture content is the difference between 0.27 and 0.18, or about 0.09. Using these numbers, a three-inch infiltration event would be completely stored in just 33 inches of initially dry ROM, based on the available porosity between 0.18 and 0.27 being 0.09. The modeling assumes that it completely fills. Once the infiltration event ends, water would continue to seep downward, drawn by gravity and a negative matric potential. However, evaporation would begin at the upper end and, as the surface soil dries, a negative matric potential would develop on the surface and begin to counter the downward movement of the stored water.

The example just given allows the soil above the wetting front to become saturated because of the large difference in effective conductivity at the wetting front, which keeps the water close enough to the ground surface for evaporation to begin to quickly remove the water after the precipitation event ends. During summer, when the larger short duration events are most likely, the daily potential evaporation is as much as half an inch per day which means that most of the precipitation stored in upper layers of the waste rock would quickly evaporate; it is clear why the modeling does not simulate deeper seepage of water.

The figures showing water content through a model cross-section are clear (Ill 5.15 and 5.16). Near the surface, the moisture content is about 0.1 which increases initially with depth to about 0.14 but then decreases to 0.04 in the consolidated zone. This moisture content is less than the lowest moisture content presented in Illustration 5.8 for consolidated material, so the accuracy of the data is questionable. Clearly the effective conductivity at that moisture is 10^{-7} ft/hr (2.4×10^{-6} ft/d), an almost negligible conductivity.

The effective gradient due to high negative matric potential may be significantly higher than 1. Even at 1000, the water would move only about 2.4×10^{-3} feet in a day. These numbers should make clear why the model does not simulate seepage through the waste rock. The small amount of moisture below the unconsolidated ROM can be simulated to move only very slowly. These numbers suggest that increasing the moisture available significantly would not result in substantial differences in moisture content at depth, meaning that whether the model considers runoff accumulating at a location is irrelevant.

Many of the water balance figures, such as Illustrations 5.12 and 5.14, show precipitation entering the system and evaporation leaving the system; because the evaporation exceeds the precipitation, water leaves storage so that the moisture content decreases. These figures present a year's results, but

presumably the waste rock would just become drier with time and evaporation would have to approach precipitation as stored water available to evaporate would dissipate. The figures also demonstrate that the model simulate almost no runoff.

The modeling does not account for preferential flow which can allow flow to move quickly through the piled waste rock. A preferential flow path in a waste rock dump is a pathway of larger pore spaces through which groundwater flow tends to funnel; it is similar to flow through fractures in in-situ bedrock. By ignoring preferential flow, the model underestimates seepage through any of the mine components, although waste rock would likely be most heterogeneous.

Tetra Tech's mention of preferential flow (TT, p. 20) refers to the fact that hydraulic conductivity for unsaturated flow varies with moisture content; different materials are preferentially more conductive at different moisture contents. More flow occurs through clay at low matric potential than through coarser sand because the sand is actually drier. The curves in TT Figure 5.5 may apply in a given facility but they would not apply at the same point (due to differing soil types at each point) so the flow cannot transition from one to the other.

The FEIS reports results from modeling seepage through waste rock dumps that are unreasonably low. This is because the modeler used unrealistic unsaturated parameters and used climate data from the wrong location.

The FEIS responded to comments by having Rosemont consider additional scenarios. The scenarios had to do with the length of simulation but with inappropriate climate values the antecedent conditions were never wet enough to allow additional seepage beyond the surface. The FEIS did not amend or address the fact that the precipitation data was wrong and the ET data was from Tucson. The presence of seepage through waste rock all over the country including in areas much drier than Rosemont demonstrates that seepage can occur.

The FEIS also does not respond to the comment about the wrong hydraulic parameters for the soil – specifically that the unsaturated conductivity was incredibly low which prevented any water entry to the waste. The FEIS did not address these problems or have Rosemont test the sensitivity of the waste rock parameters in their model

Conclusion and Recommendations

☐ **The EIS must present data justifying the conductivity parameters.** It is not reasonable for ROM rock with saturated $K = 170$ ft/hr to only allow seepage to move a few feet before being removed by exfiltration.

☐ **The study should be redone to include a sensitivity analysis.**

If the conductivity for high matric potential rock is set higher and there is still no seepage, then the EIS may be able to conclude there is no seepage. Otherwise, the results of this seepage study are simply uncalibrated estimates based on very unrealistic parameters.

Objection: The FEIS ignores the high probability of preferential seepage flow in the tailings and waste rock piles

The DEIS must justify the parameters used and complete a sensitivity analysis of the parameters to

demonstrate that the results of the seepage modeling are feasible; this is especially needed since there is no data to calibrate to. They must also justify ignoring preferential flow paths through the waste rock. The mine facility seepage analysis predicts there will be essentially no seepage through waste rock facilities, a result that is simply not feasible. The modeling used parameters in which the conductivity for relatively dry rock is six orders of magnitude less than when saturated. These parameters would allow a wetting front to move through unsaturated waste rock only very slowly; even most of a large event would be stored in the top few feet. After the storm ends, the close proximity of most of the seepage to the ground surface would allow the water to be evaporated away because evaporation would quickly establish an upward matric potential gradient.

The modeling does not account for preferential flow which can allow flow to move quickly through the piled waste rock. A preferential flow path in a waste rock dump is a pathway of larger pore spaces through which groundwater flow tends to funnel; it is similar to flow through fractures in in-situ bedrock. By ignoring preferential flow, the model underestimates seepage through any of the mine components, although waste rock would likely be most heterogeneous.

Tetra Tech's mention of preferential flow (TT, p. 20) refers to the fact that hydraulic conductivity for unsaturated flow varies with moisture content; different materials are preferentially more conductive at different moisture contents. More flow occurs through clay at low matric potential than through coarser sand because the sand is actually drier. The curves in TT Figure 5.5 may apply in a given facility but they would not apply at the same point (due to differing soil types at each point) so the flow cannot transition from one to the other.

FEIS claims that seepage would not be concentrated but would rather be spread across the entire area of the facility. The FS rejects good science and observations at literally every waste rock seep showing that seepage discharges from a point, not spread around the base of the facility.

Preferential flow would cause seepage through waste rock (and tails) to reach the ground surface at concentrated locations rather than spread over the entire area of the facility. This is unaccounted for in the modeling and the FEIS in general. Because preferential flow has the potential to significantly impact downstream waters and habitats, the models should be re-run to account for this phenomenon.

Objection: The FEIS waste rock seepage monitoring plan will not result in adequate seepage impact evaluation .

The monitoring plan calls for two points to be monitored for moisture content. The waste rock dumps cover a large area, but the FEIS suggests there will be no seepage. Objection 7 deals with the high probability of preferential flow in the piles, which means that actual seepage will likely be concentrated. The mitigation plan in the FEIS calls for monitoring seepage in just two locations. Because preferential flowpaths could develop almost anywhere, there is little chance that the proposed monitoring will actually detect seepage if it occurs.

ADEQ's Basis states that "should the seepage reach surface waters, an individual AZPDES permit would be required and discharges would have to meet the appropriate surface water quality standards individual antidegradation." However, neither ADEQ nor Forest Service have provided for monitoring to

detect seepage that has reached surface waters, except if the seepage reaches the compliance point dams. ADEQ should require detection and reporting of any inadvertently created surface water features created in and around the mine site upstream of the Barrel Canyon compliance dam. Detections should trigger monitoring to assure that any unplanned water bodies are meeting state water quality standards.

Attachment 1

Objections Related to Stormwater Management

Throughout the EIS process, the County has commented on the issue of stormwater management at the Rosemont site and the impacts of the proposed management methods on downstream waters, both above-ground and below. The County continues to believe that the impacts on those waters will be substantially greater than predicted in the FEIS.

Comments filed by the County include:

- a. The reduction of flows to downstream during the first 10 years of operations will put the offsite riparian areas at risk. County PAFEIS comments, p. 68.
- b. Cumulative impacts of the reduction of storm flows downstream of the project site have not been evaluated. The FEIS focuses on the changes in either annual runoff or storm peak flow but ignored the cumulative impacts over the 20 years active mining life. Long-term, cumulative impacts of the reduction of flow from the project site on Davidson Canyon and Cienega Creek need to be evaluated. County PAFEIS comments, p. 73.
- c. The impacts of mining activities on sediment transport could change over time during the active mine life and after the closure. The FEIS reported that the reach of Davidson Canyon is currently a sediment transport-limited system. However, with a reduction in sediment load from the project area over time, it is possible that loose sediment is washed out and as a result the sediment transport system could be changed. The changes in sediment balance could affect the fluvial geomorphology of the Davidson Canyon and Cienega Creek. Appropriate sediment transport analysis is necessary to estimate long-term impacts of mining activities on channel geomorphology, vegetation and fluvial system of the "Potential Waters of the United States". Cumulative impacts of possible changes in sediment transport system on "Potential Waters of the United States" over time should be disclosed. County PAFEIS comments, p. 78.
- d. The FEIS acknowledged that there will be a reduction in sediment yield from Barrel Canyon watershed but no change in the geomorphology of the channel is expected. The FEIS only discusses about annual average sediment delivery. The FEIS did not consider cumulative impacts of sediment delivery change over the active mine period and post-closure. Considering the proposed active mine life is over 20 years, the FEIS should assess long term impacts on sediment yield, delivery and channel geomorphology. County PAFEIS comments, p. 79.
- e. The FEIS acknowledges that the modification of stormwater peak flows and volume is important in multiple aspects. However, the FEIS does not include any plans to address possible issues resulting from the modification of storm flow. For example, what would happen if the reduction of runoff volume significantly affects Davidson Canyon and Cienega Creek? The FEIS lacks a "backup" plan. Please explain what actions would be taken when problems are identified. County AFEIS comments, p.72.
- f. The FEIS acknowledges that some water sources would be impacted (p.31, L.30). However, the FEIS did not clearly explain who would be responsible of addressing issues. Please cite a responsible party to address potential issues, threat to health and natural resources and explain how to address issues when identified. County PAFEIS comments, p.73.
- g. How will the monitoring data be used? What would happen if the monitoring data shows problems? The FIES should explain what actions would be taken when a problem arises. County PAFEIS comments, p. 73.

- h. What action would be taken if monitoring data shows the impacts to surface water quality in the Davidson Canyon during active period and post-closure? County PAFEIS comments, p. 79.
- i. How long will the Rosemont Copper fund USGS to monitor the flow after the closure? The monitoring should continue after the closure to assess the mitigation effectiveness. County PAFEIS comments, p. 73.
- j. The analysis of downstream water volume effects on Davidson Canyon and Cienega Creek is flawed, because *Predicting Regulatory (100-yr) Hydrology and Average Annual Runoff Downstream of the Rosemont Copper Project* (Zeller, 2011a) ignores the fact that greater rainfall occurs higher on the high elevations like the mine site, and will contribute more water to downstream areas than low elevation watersheds. By assuming that all areas contribute runoff equally underestimates the impact the mine site will have on surface water and riparian habitat in Davidson Canyon and Cienega Creek. Therefore, Rosemont should revise the analysis to more accurately reflect the effect the differences in rainfall depths on downstream runoff and its impact on riparian habitat. County PAFEIS comments, p. 68.
- k. The recognition that fires occur in the project area, that the largest burn areas have occurred since 2005 and that fires can dramatically impact the hydrologic regime should include a plan to address these concerns. There is no acknowledgment of associated hazards which occur in post-fire conditions including gullying/erosion and debris flows which could impact drainage infrastructure both during operations and post closure. There are many examples of gullying and post fire debris flows, including the Schultz fire that occurred near Flagstaff in 2010. Therefore, PAEIS does not offer a plan to address a likely hazard to occur in the project area during the operations and post-closure of the mine (i.e. fire and the associated flooding and debris flow hazard) and it should. County PAFEIS comments, p. 68.
- l. *The method used to estimate erosion is not appropriate to evaluate the impact of mining alternatives and is far below industry standards.* While Rosemont's consultant, Tetra Tech, has justified their use of the PSIAC method (Tetra Tech, August 18, 2011, comment 2), the two studies cited by Tetra Tech (Rasely, 1991; Renard *and* Stone 1982 [Tetra-Tech neglected to mention the co-author Stone]), clearly state that the PSIAC method is inappropriate for site level assessment. County PAFEIS comments, p. 80.
- m. The PAEIS erroneously states that Pima County recommends the PC-Hydro model for determining peak flows. Instead, RFCDD Tech Policy 015 describes which hydrologic model should be used in different situations, and Tech Policy 018 describes how these models should be applied. County PAFEIS comments, p 67.
- n. Because of the need to reassess the hydrologic information provided in the DEIS, a Supplemented Environmental Impact Statement (SEIS) should be provided that includes the following studies:
 - 1.) *Evaluation of the impact of mine on habitat in Davidson Canyon – An Outstanding Water of the State of Arizona.* Because the DEIS describes an approach that captures rainfall on the mine site, and limits downstream discharge, the impact of this approach on downstream resources should be evaluated, especially in light of the fact that Davidson Canyon is an Outstanding Water of the State of Arizona.
 - 2.) *Hydrologic evaluation that uses 'critical' storms and approved hydrologic methods to design structures for peak flow rates.* Design should adopt the FEMA criteria for flood peak determination rather than use 24-hr storms. In Pima County, these are peak from

Intensity-Duration curves, such as used in PC Hydro, and shorter duration high intensity rainfall events, such as 3-hr storms.

- 3.) *Hydrologic values that consider longer-term storm durations (1-week) for volume design.* Because recent events have shown that rainfall over several days can cause flooding and overwhelm ponds, a more critical (and conservative) evaluation of the hydrology used to design volume control is required.

County DEIS comment, No. 386.

- o. Hydrologic evaluation that uses 'critical' storms and approved hydrologic methods to design structures for peak flow rates. Design should adopt the FEMA Criteria for flood peak determination rather than use 24-hr storms. In Pima County, these are peak from Intensity-Duration curves, such as used in PC Hydro, and shorter duration high intensity rainfall events, such as 3-hr storms. County DEIS comment, No. 63.
- p. The Forest recognizes the ephemeral stormwater flow from the project area would change, primarily as a result of the retention of water at the project site. Although the FEIS acknowledged that several cooperating agencies expressed concerns of the amount of water removed and a resulting serious impact to downstream riparian resources, the FEIS did not evaluate how the water removal could impact downstream riparian resources over time (pre-mining, active mining and postclosure periods). Please disclose cumulative impacts of the reduction of storm water to riparian vegetation, channel geomorphology and groundwater drawdown. County PAFEIS comment, p. 71.

Objection 1. Impacts on outstanding Arizona Waters for all mining life phases (especially first 10 years) not disclosed.

The FEIS states that "the only potential effect on the Outstanding Arizona Waters in Lower Davidson Canyon and Lower Cienega Creek would be the result of a decrease in runoff that would occur because portions of the Davidson Canyon watershed would be cut off in perpetuity by the mine site. This reduction in ephemeral flow is estimated to be 4.3 to 11.5 percent in lower Davidson Canyon." In comment reference "a", above, the County points out that these flow reductions will put the riparian habitat at risk. However, the FEIS never discusses the resulting impacts. It focuses only on the "post-closure" conditions. As mentioned above, during first 10 years active mining phases, estimated runoff reduction from Barrel Canyon is significant. FEIS should disclose the impacts on Outstanding Arizona Waters for different phases by using estimated runoff during that period. Failure to disclose and analyze these impacts is contrary to the Forest Service's charge under NEPA.

Objection 2. Cumulative impacts on downstream riparian and water resources, Davidson Canyon, and Cienega Creek not fully disclosed.

As pointed out in comment reference "b", above, the FEIS fails to assess cumulative impacts of the runoff reduction (it focuses only on the post-closure condition) on downstream riparian and water resources and Outstanding Arizona Waters. These impacts are not fully analyzed in "Cumulative Effects" section in the FEIS. The FEIS should assess cumulative impacts of runoff reductions from the active mining period to the post-closure. Failure to disclose and analyze these impacts is contrary to the Forest Service's charge under NEPA.

Objection 3. Long-term impacts of reduction of sediment yield have not been fully disclosed.

The FEIS does not address the two comments referenced in “c” and “d”, above. The impacts of mining activities on sediment transport could change over time during the active mine life and after the closure. The FEIS's statement of "As a whole, these changes are unlikely to be significant when assessed in the context of the watershed as a whole." is not reasonable without long-term analysis for all phases of mining life. Long-term and cumulative impacts of the reduction of sediment yield on Arizona Outstanding Waters should be analyzed. Failure to disclose and analyze these impacts is contrary to the Forest Service's charge under NEPA.

Objection 4. There is no explanation about possible actions to be taken to restore damages of downstream water and riparian resources.

There is no question that the Rosemont mine will impact downstream and riparian resources. However, as pointed out in referenced comments “e”, “f”, “g”, and “h”, above, the FEIS and draft ROD lack any discussion of what step will be taken to address these impacts when they become apparent. The FEIS should identify contingency mitigation steps for likely impacts and the ROD should include obligations to implement the mitigation measures when impacts become apparent.

Objection 5. Unclear description of the storm water monitoring plan.

As pointed out in referenced comment “i”, above, there must be a plan for post-closure monitoring to ensure that mitigation efforts are effective. The FEIS and draft ROD fail to fully explain how this monitoring will be funded. It is critical that post-closure monitoring occurs and that the responsible funding source be identified in the ROD.

Objection 6. The FEIS underestimates the reduction of Surface Water and Impacts to Outstanding Waters of the State of Arizona

Referenced comment “j”, above, identifies flaws in the methods of estimating impacts to Surface Water and Impacts to Outstanding Waters of the State of Arizona. Appropriate runoff volume calculation is important. The potential reduction of average annual runoff losses for Davidson Canyon are calculated based on the reduction of area only, but we know that runoff is derived from rainfall and more rain occurs at higher altitudes, such as the mine site.

The analysis of downstream water volume effects on Davidson Canyon and Cienega Creek is flawed, because *Predicting Regulatory (100-yr) Hydrology and Average Annual Runoff Downstream of the Rosemont Copper Project* (Zeller, 2011a) ignores the fact that greater rainfall occurs higher on the high elevations like the mine site, and will contribute more water to downstream areas than low elevation watersheds.

This indicates that the impacts on Outstanding Arizona Waters are underestimated. Reduction of annual post-closure runoff volume will be larger. The FEIS fails to properly address the County's flow estimates and, as a result, fails to fully identify the significant environmental impacts and potential mitigation steps, as required by NEPA regulations.

Objection 7. The FEIS does not consider risk from the likelihood of post-fire sediment impacts.

Comment reference “k”, above, points out that the mine area has a significant potential for fire impacts. A fire could substantially impact stormwater management systems related to the mine and cause them to fail. The FEIS fails, despite the County comment, to adequately consider fire impacts on stormwater

flows and quality and potential steps to mitigate those impacts. This failure is contrary to the NEPA obligation to identify significant environmental impacts and means to mitigate those impacts.

Objection 8. The method used to estimate erosion is not appropriate to evaluate the impact of mining alternatives (as determined by the developers of the methods themselves) and is far below industry standards.

In referenced comment “l”, above, the County explained that the erosion estimating model, the PSIAC method, is inappropriate for use in scenarios like the Rosemont. This viewpoint is consistent with prior statements by the models’ author. Despite this knowledge that the model developer does not recommend the model for this purpose, the model continues to be a basis for the FEIS analysis of erosion impacts. Use of inappropriate models is arbitrary and capricious.

Objection 9. The Hydrologic Analysis is Inadequate and the Report Misrepresents the Hydrologic Analysis performed

Pima County clearly stated that the consultant should consider the results of a 3-hr storm (comment reference “n”), which was never done, and the FEIS implies that Pima County's concerns were addressed in the analysis they did, while they were not. In referenced comment “m”, above, Pima County reiterated that the consultant erroneously stated that Pima County recommends the PC Hydro model for determining peak flows, and stated that Pima County has technical policies 15 and 18 that describe which models should be used for which application.

The FEIS inaccurately states that the methods presented in the 'Golder Model (p. 402)' (assumed to be Baxter and Patterson, 2012) follows the methods 'prescribed' by Pima County in the 01-12-12 comment letter. Referenced comment “o”, above, specifically states that modeling should consider 'shorter duration high intensity rainfall events, such as 3-hr storms.' These were not included in any analysis we have seen supporting the surface water evaluation. Use of improper data and modeling for EIS purposes is arbitrary and capricious.

Objection 10. Potential impacts on downstream riparian and water resources for all phases of mine life are not fully disclosed

In comment reference “p”, above, the County points to a lack of disclosure regarding stormwater impacts to downstream riparian and water resources during earlier phases of the mine life. The estimated reduction of annual runoff flow volume to downstream is 30-40% during pre-mining and active mining phases (SWCA, 2013). This substantial reduction of runoff to downstream could significantly affect downstream riparian and water resources. Although the potential impacts of the runoff reduction are briefly discussed in "Seeps, Springs and Riparian Areas", the FEIS only focused on the post-closure 17% reduction and did not fully analyzed the runoff reduction impacts on downstream vegetation and water resources for all phases of mine life. This failure is contrary to the NEPA obligation to identify significant environmental impacts and means to mitigate those impacts.

Attachment 2

TECHNICAL MEMORANDUM

Date:	July 18, 2012	Project No.:	093-81962.0007
To:	Chris Garrett, P. HGW.	Company:	SWCA Environmental Consultants
From:	Jennifer Patterson and George Annandale	Email:	JMPatterson@Golder.com GAnnandale@Golder.com
RE:	GEOMORPHIC ASSESSMENT OF BARREL CREEK		

Golder Associates Inc. (Golder) was requested to conduct a qualitative geomorphic assessment of Barrel Creek. The goal was to determine the current geomorphic condition and develop an opinion on potential geomorphic changes that could occur with the development of the Rosemont Mine. This letter presents observations from the fieldwork and opinions on potential geomorphic changes that might result due to proposed development of Rosemont Mine.

1.0 INTRODUCTION

Barrel Creek is an ephemeral arroyo located about 25 miles southwest of Tucson (Figure 1). Historic downcutting is evidenced by relatively high banks that are near vertical. This cross-sectional geometry is typical for streams in the arid and semi-arid West. Water flows in the creek only after local precipitation events occur within the watershed. The average annual precipitation estimated at the Rosemont Mine site is 17 inches (USFS 2011). The majority of the precipitation falls during the monsoon period from early July to late August. During the monsoon period, intense thunderstorms build in the late afternoon causing heavy precipitation and flash floods. Streams such as these have extremely high sediment transport rates (for example, Reid, et al., 1998 and Greenbaum and Bergman 2006).

2.0 FIELD OBSERVATIONS

Ms. Jennifer Patterson and Dr. George Annandale conducted a field assessment of Barrel Creek from the headwaters to the confluence with Davidson Canyon on May 1 and 2, 2012. Photographic documentation of the site is recorded from upstream to downstream in the Photographs section below. The photographs illustrate the typical observations from the site.

Two important, geomorphic observations were made during the field visit. The first is that the system is sediment-transport limited. The second is that there is bedrock grade control within the creek upstream of the confluence with Davidson Canyon. Each of these observations is detailed below.

2.1 Sediment-transport Limited

When evaluating the potential impacts for a system, one should consider whether the system is sediment-supply limited or sediment-transport limited. Sediment-supply limited means that the river is transporting as much sediment as is available. The riverbed in a sediment-supply limited system will be composed of

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an armor layer that is transported only during relatively high flows or the bed may be composed of bedrock. An extreme example of sediment-supply limited is “hungry water” that can occur downstream of a dam.

Sediment-transport limited is the exact opposite. There is more sediment in the system than the river can transport during normal or even flood-flow conditions. The sediment-transport limited system is common in ephemeral streams, because of the flashy nature of these systems. A large precipitation event will create a pulse of water flowing down the creek. On the rising limb of the hydrograph, the water picks up more and larger particles of sediment and transports them downstream. However, the hydrograph is short. Typical hydrographs contain multiple peaks due to slugs of precipitation from different areas of the watershed (Reid, et al., 1996). The sediment is dropped out of suspension on the falling limb of the hydrograph. Sediment is transported downstream, but it is deposited a relatively short distance from the source. In a sediment-transport limited system, the bed material will be poorly sorted (i.e., all gradations are present). The bed material will be loose, and an armor layer will not be present (Hassan, et al., 2005).

Barrel Creek is a classic example of a sediment-transport limited system. It is ephemeral, which means that the water only flows occasionally and usually after a precipitation event. The flashy nature of the flows means that sediment is not transported on a regular basis. The bed is composed of a thick layer of unconsolidated sands, gravels, and cobbles. These types of sediment are readily transported during any significant flows within the creek, but the transport stops as quickly as it starts.

Evidence observed in the field confirming that Barrel Creek is a sediment-transport limited system includes the following:

- Deep, unconsolidated, poorly sorted bed material
- Angular particles
- Localized erosion that is not propagating upstream
- Deposited materials on top of bedrock and under bridge

The deep, unconsolidated, poorly sorted bed material also indicates that the system is dropping particles out of suspension in a relatively short time. If the tail of the hydrograph were long, the bed materials would be sorted with coarser material underlying the fine-grained sands. However, the material is just dropped out of suspension at roughly the same time as the water infiltrates into the substrate and quickly disappears. It is deep and unconsolidated, which indicates that it is readily transported with any significant flow. The system has the materials ready to be transported, but it is transport-limited because it is ephemeral.

The angular particles in the bed material indicate that the sediment is not being transported for long distances or for long periods of time. When sediment is transported, it rubs against the bed, bank, and other suspended particles. This will make each grain smoother and rounded. The presence of angular gravels and cobbles indicates that the system is only transporting materials for short times.

Localized erosion was observed in the field in a few locations (for example Photographs 8 and 12). However, this erosion is not propagating upstream. If the system were actively down cutting, the apron on the downstream side of the Barrel Creek Bridge would be severely undercut. But instead, there is a small drop indicating that sediment is not being actively eroded.

The loose sands being deposited on top of bedrock (Photograph 19) and under the bridge (Photograph 11) illustrate the deposition of material at the falling limb of the hydrograph. The grain size is small enough to be transported during any significant flow event. The system is sediment-transport limited.

2.2 Downstream Grade Controls

The second critical geomorphic observations made in the field are the downstream grade controls. A grade control is a critical component of a stream, because it limits the extent of any potential change in the stream gradient. The schematic in Figure 2 illustrates how a grade control limits the extent of erosion both upstream and downstream of the structure. The grade control will stop any upstream migration of head cuts. The grade control acts as a pivot point for the gradient of a river, so erosion upstream of the grade control is also limited.

During the field investigation, two grade controls were identified, as follows:

- Bridge at Barrel Creek (Photograph 9)
- Bedrock across river bottom (Photograph 23)

The upstream grade control is the bridge at Barrel Creek; it is a man-made structure. Because it is man-made, there is the potential that this structure may fail at some time in the future. The downstream grade control is made of bedrock that is erosion resistant, so it will continue to control the stream gradient for an extremely long time. These structures control the hydraulic gradient and therefore the stream power of the creek. The grade controls will limit the erosion capacity of the stream (Figure 2) and a control on depositional processes.

3.0 GEOMORPHIC IMPLICATIONS FOR DEVELOPMENT IN WATERSHED

Concerns have been expressed about the potential impact of the development of the proposed Rosemont Mine on the geomorphology of Barrel Creek and Davidson Canyon. Degradation of these channels, should it occur, could potentially affect the Outstanding Waters of Arizona located in lower Davidson

Canyon. The geomorphologic investigation that was conducted addresses this concern, indicating that the proposed mine development will have no significant impact on the geomorphology of either Barrel Creek or Davidson Canyon.

The geomorphology of fluvial systems is largely dependent on three factors: i.e., water flow, sediment characteristics and availability, and the geometry of stream channels. The justification for stating that the mine will not have a significant impact on Barrel Creek and Davidson Canyon can be formulated in terms of these three variables:

3.1 Sediment

- The area affected by the mine is roughly equal to about 13% of the entire catchment area upstream of the Outstanding Waters of Arizona, located in Davidson Creek (SWCA 2012). Changes in sediment load and runoff from such a small portion of the entire catchment will not have a significant impact on the fluvial geomorphology of the stream system.
- In the worst case, it is estimated that the impact of the mine on total sediment load upstream of the Outstanding Waters of Arizona will amount to a reduction of about 4% (SWCA 2012). This difference between current and predicted sediment load is within the statistical noise of the fluvial system. An estimated change of about a couple percent is therefore deemed insignificant.
- Abundant availability of loose sediment on the surface of the catchment surrounding Barrel Creek and Davidson Canyon will continue to supply directly sediment to the streams during rainstorm events, regardless of the presence of the mine. The amount of sediment thus supplied is greater than what the flowing water can carry, characterizing the transport-limited nature of the stream system.

3.2 Geometry

- The natural grade control that is characteristic of the stream system prevents riverbed degradation and will maintain the sediment transport capacity of the flowing water, regardless of the planned mine development. Maintaining the sediment transport capacity at historic levels and not significantly altering the sediment load to the stream will retain the current geomorphologic character of Barrel Creek and Davidson Canyon, regardless of mine development.

3.3 Water Flow

- It is uncommon for the catchment of Barrel Creek and Davidson Canyon to be subjected to large storm events covering the entire area. Instead, convective storms of limited size occur over portions of the catchment when it rains. The scattered nature of such storm events results in generation of sediment supply from diverse locations in the catchment at different points in time. It rarely happens that sediment would be generated simultaneously from the entire catchment. The nature of sediment supply based on the isolated nature of storms will remain and not be significantly impacted by the mine.
- The transport-limited nature of Barrel Creek and Davidson Canyon explains the non-degrading nature of the stream system. The nature of the stream system will remain unchanged because the change in sediment supply due to the presence of the mine is insignificant, and the sediment transport capacity of the water will essentially remain the same due to the presence of naturally occurring grade control features. It is therefore

reasonable to expect that the creek will not degrade; particularly not near the Outstanding Waters of Arizona in Davidson Canyon and beyond. The creek will remain in a state of quasi-equilibrium; expected from a semi-arid, ephemeral stream.

4.0 REFERENCES

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Attachment 3

Comments on the interpretation of isotope data at Rosemont

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Prepared for Julia Fonseca, April 4, 2014

Abbreviations

TT = Tetrattech

ELM = E.L. Montgomery and Associates

LMWL = Local Meteoric Water Line

GMWL = Global Meteoric Water Line

masl = meters above sea level

Local Meteoric Water Line at Rosemont

Figure 8 of ELM (2009) shows a LMWL with a slope of 5.8. This is based on data I provided at the request of ELM, but as I remember it is a relatively small subset of the total data set we have for Tucson, 740 masl (Fig. 1A). A longer-term view of the data suggests that LMWLs vary from year to year (Wright, 2001). In the long term, there are two lines in Tucson. For $\delta^{18}\text{O} < -7\text{‰}$, the line has a slope of 7.6 and closely approximates the GMWL. For $\delta^{18}\text{O} > -3\text{‰}$, a second line emerges, with slope of 4.6. This is a typical evaporation trend. The intersection of the two lines occurs near $\delta^{18}\text{O} = -5.5\text{‰}$.

These lines can be compared with data for Palisades Ranger Station, 2420 masl (Wright, 2001, and unpublished data; Fig. 1B). The data form a trend of slope near 8 (compare the GMWL), with a suggestion of an evaporation trend at $\delta^{18}\text{O} > -5\text{‰}$, but the evaporation effect is much less developed than in the Tucson data. Together, the two plots imply that the evaporation line in Tucson results from the falling of rain through dry, hot air at low elevations, an effect that diminishes in importance towards to mountain tops. The Rosemont pit site is at about 1500 masl, and precipitation at the site most likely has stable isotope distributions (ranges, and trends on the δD vs. $\delta^{18}\text{O}$ plot) between those of the Tucson and Palisades stations.

Recharge seasonality at Rosemont

The data for the Tucson and Palisades stations, weighted for precipitation amount, are the basis of the altitude dependence lines shown in Fig. 2. These lines represent long-term precipitation records; altitude effects from year to year are variable (Eastoe and Dettman, submitted). This figure can be used in the following way: a spring discharging at 1500 masl, for instance, yields

water that fell as precipitation between 1500 masl and the crest of the local topography. For groundwater that represents mixing of recharge over several years, and undergoes minimal evaporation prior to recharge, the diagram provides constraints on the seasonality of recharge in the catchment of the spring. If such groundwater had a $\delta^{18}\text{O}$ value of -5 ‰ at 1500 masl near Rosemont, predominant summer recharge would be indicated. For a $\delta^{18}\text{O}$ value of -9 ‰, combined summer and winter recharge would be indicated, and for -10‰, predominant winter recharge.

The isotope data for springs and wells in ELM's Figure 8 have been interpreted by ELM (2009) as a linear trend approximating a LMWL, the latter probably an inadequate estimate of the true LMWL(s) as suggested above. An alternative interpretation is that the data compose two trends: for $\delta^{18}\text{O}$ values < -9.5 ‰, a trend close to the GMWL for least evaporated samples, and for $\delta^{18}\text{O}$ values > -9.0‰, an evaporation trend of slope near 5 (Fig. 1A).

If the isotopic variation in precipitation in the Santa Rita Mountains resembles that in Tucson and the Santa Catalina Mountains, the intersection point near -9.5‰ does not reflect evaporation of falling rain. An alternative explanation for the isotope data is that infiltration of surface water with original (as precipitation) $\delta^{18}\text{O}$ values of -9.0 to -11.0‰ predominates. For -9‰, the recharge corresponds to mixed summer and winter precipitation, and for -11‰, to winter precipitation (Fig. 2). Infiltration of water that fell as rain with $\delta^{18}\text{O}$ values of long term average near -9.5 ‰ is common, accounting for more than half of the groundwater data points in ELM's Fig. 8. Evaporation of surface water prior to infiltration is also common, and evaporated versions of precipitation having $\delta^{18}\text{O}$ values of -9.0 to -14.0‰ are present in the data set. Precipitation with $\delta^{18}\text{O}$ > -9‰ does not appear contribute to recharge in a detectable quantity.

The outlying data point with $\delta^{18}\text{O}$ = -12.4‰ cannot be explained by average winter recharge either on the ridge above Rosemont pit, or in the high elevations of the Santa Rite Mountains. This sample has a ^{14}C content of 16 pMC, (ELM, 2009) and appears to represent precipitation from a period of cooler, wetter climate.

Davidson Canyon subflow

In TT's Fig. 17 (TT, 2010), four data points from springs in the bed of Davidson Canyon plot with $\delta^{18}\text{O}$ values near -7‰. An extra data point, not plotted, is listed in ELM's Table 12, and has $\delta^{18}\text{O}$ = -9‰. It is understood that these samples were collected with the aim of obtaining a long-term average for the isotope composition of Davidson Canyon subflow. The presence of a variation of more than 2‰ in such samples over a short period of time suggests that the

isotopes in the subflow groundwater respond to variations in isotopes in precipitation at a timescale corresponding to individual precipitation events or seasons. Using these data as an indication of the characteristic seasonality of recharge in the Davidson Canyon watershed constitutes an over-interpretation of a small data set for an incompletely understood groundwater system. In particular, the data point omitted from TT's Fig. 8 leaves open the possibility that groundwater abundant in the area of the Rosemont pit can contribute to Davidson Canyon subflow.

Figure Captions

1. A. Plot of δD vs. $\delta^{18}O$ for individual rain events at the University of Arizona station, central Tucson. Data in near the inflection point have been omitted to enable determination of trend lines. The red trend line is the evaporation trend for groundwater at Rosemont (cf. ELM's Fig. 8). B. Plot of δD vs. $\delta^{18}O$ for individual rain events at the Palisades ranger station, Santa Catalina Mountains.
2. Plot of elevation vs. $\delta^{18}O$, with altitude3 dependences of $\delta^{18}O$ based on data from the University of Arizona and Palisades stations. Elongate rectangles indicate altitude ranges in the Rosemont area. Other rectangles indicate isotope data ranges for springs in the altitude range show.

References

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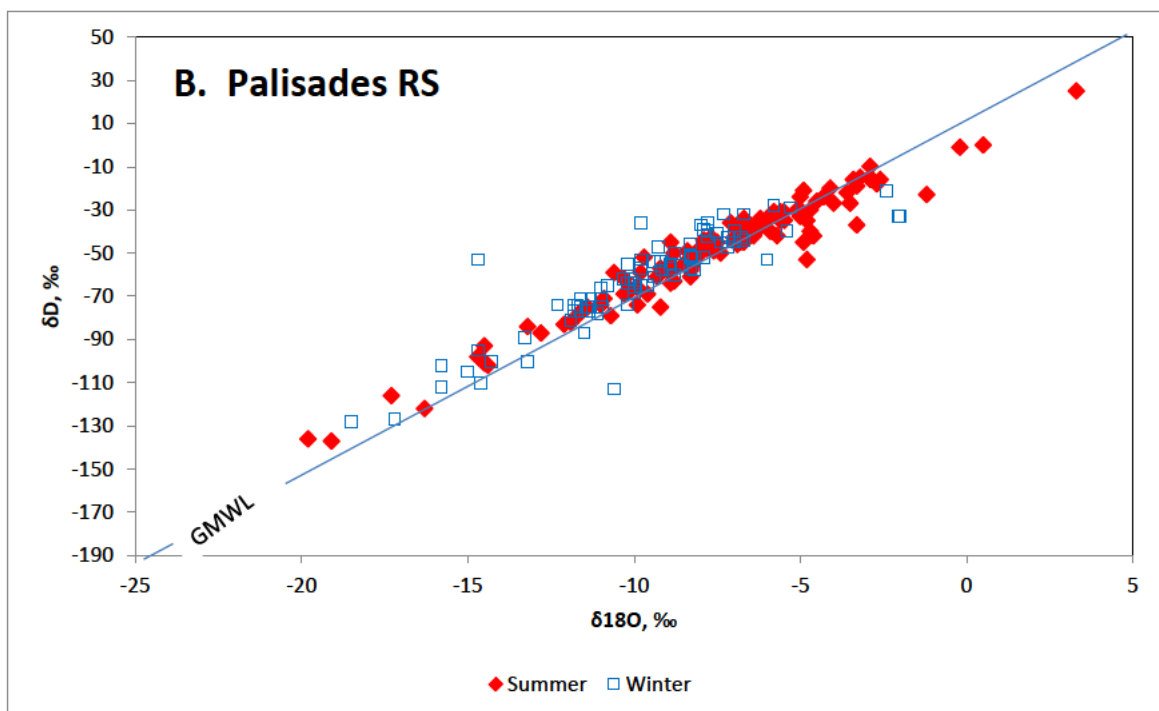
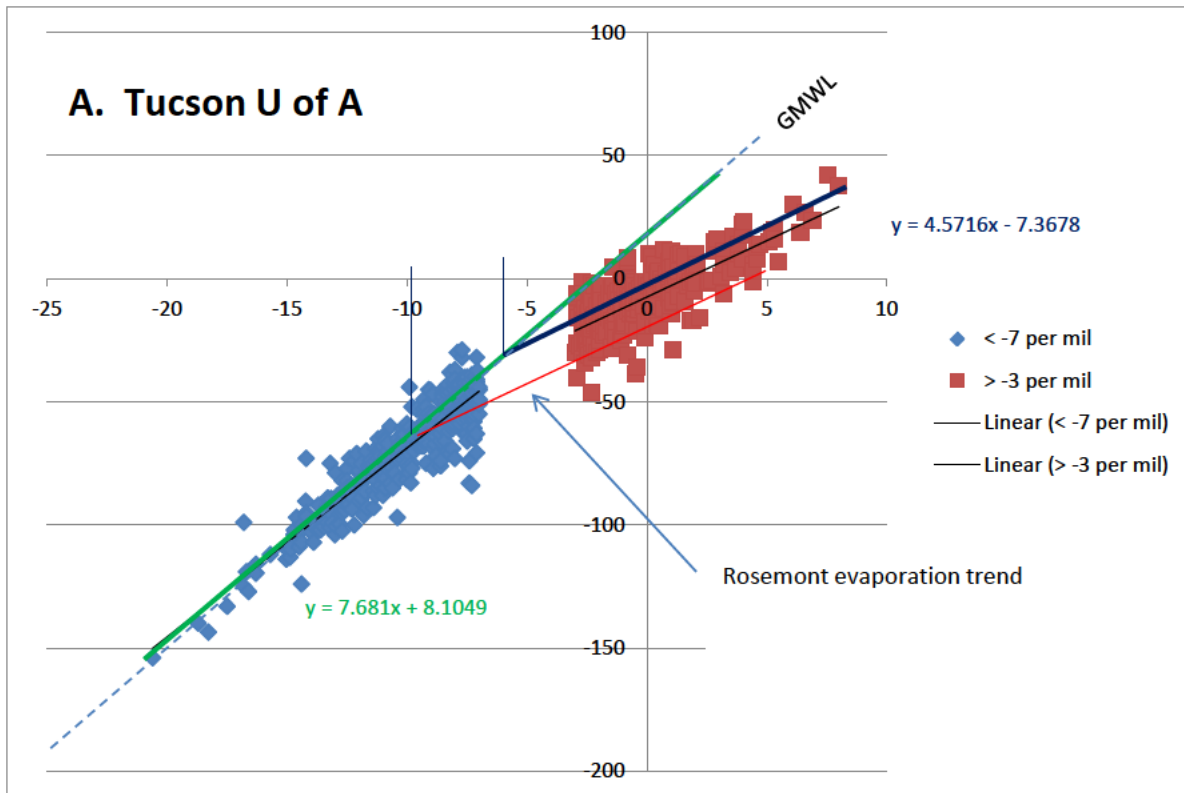
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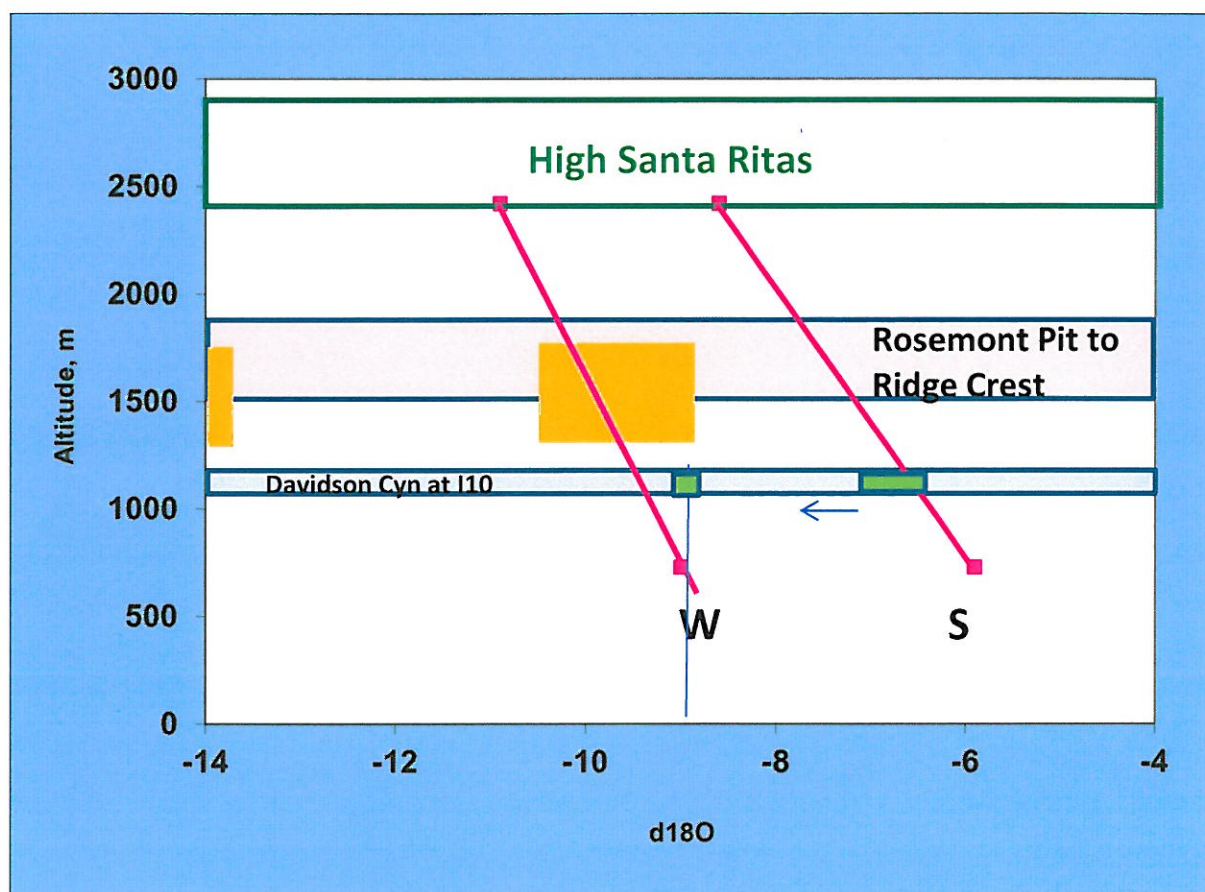
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This calculation omits 6 summer outliers





- Springs and wells, Rosemont
- Base flow in Davidson Cyn at I10
- Possible evaporation shift
- Altitude dependences from Sta. Catalinas